FEASIBILITY STUDY

FOR THE

ROSE CHEMICALS SITE
HOLDEN, MISSOURI

FOR

CLEAN SITES, INC.

JANUARY 1990

88-025-4

Burns & McDonnell Engineering Company
Engineers-Architects-Consultants
Kansas City, Missouri

TEXAS · ARKANSAS · LOUISIANA

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January 15, 1990

Mr. Steven E. Kinser
U.S. EPA, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

SUBJECT: ROSE CHEMICALS SITE, HOLDEN, MISSOURI
SUBMISSION OF DRAFT FEASIBILITY STUDY REPORT

Dear Mr. Kinser:

Attached, please find three (3) copies of the draft Feasibility Study (FS) for the Rose Chemicals site, Holden, Missouri. This report is based on the results of the Remedial Investigation which was submitted to you on September 1, 1989, and incorporates suggestions received from you during the December 6, 1989, meeting held at your office.

The draft FS was conducted in accordance with EPA guidance documents. After detailed consideration of eight remedial alternatives (with several sub-alternatives), we have arrived at two which we feel are equally protective of human health and the environment. These two alternatives are identical in most respects; they differ only in treatment of the building slabs and PCB soils. In the first alternative the slabs and soils would be capped on-site, and in the second alternative, they would be removed to a RCRA landfill.

In keeping with your request, we have not included a remedial alternative recommendation in the draft FS, but clearly the capping alternative meets both the threshhold criteria and all the balancing criteria of SARA. Consequently, the Rose Chemicals Steering Committee strongly urges the selection of this alternative by the Environmental Protection Agency for issuance in the Record of Decision for the Rose Chemicals Site.

Please review the report and provide any comments you may have to the Rose Chemicals Steering Committee. The comments can either be submitted to our RI/FS Task Force Chairman, in writing, at the address listed below, or at a meeting which will be scheduled at a later date, attended by you and representatives of the RCSC:

Joseph M. Kwasnik
RI/FS Task Group Chairman
New England Power Service Company
25 Research Drive
Westborough, Massachusetts, 01582
(508) 366-9011, Extension 2070

A copy of this report is also being submitted to Mr. Keith Schardein, of the Missouri Department of Natural Resources in Jefferson City, Missouri.

Very truly yours,

Jay A. Pruett

Jay A. Pruett, Vice Chairman
Rose Chemicals Steering Committee

JAP:lc

Enclosures

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EXECUTIVE SUMMARY

A. INTRODUCTION

1. PURPOSE AND ORGANIZATION

This Feasibility Study (FS) identifies, evaluates, and recommends response alternatives for the Rose Chemicals Site (Site) in Holden, Missouri. The evaluated alternatives protect human health and welfare and the environment, and they encompass a wide range of options as suggested by Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, U.S. EPA, October 1988 (EPA Guidance). This document is prepared in accordance with the U.S. EPA-approved Final Work Plan For Remedial Investigation/Feasibility Study at Rose Chemicals Site in Holden, Missouri, ERT Engineering Company, June 30, 1988 (Final Work Plan).

The report is divided into four parts. Part I presents purpose, report organization, and Site background information. Part II develops response action objectives based on health exposure limits and applicable or relevant and appropriate requirements (ARAR) exposure limits for the media of interest; estimates media areas and volumes requiring response action; and identifies and screens general response actions and technologies appropriate to the media of interest. Part III develops and screens each alternative. Each alternative utilizes a combination of medium-specific technologies and is designed to address the entire Site. The alternatives are screened based on their potential effectiveness, implementability, and cost. Part IV provides a detailed analysis of the screened alternatives and recommends a preferred response alternative.

2. SITE BACKGROUND

The Site consists of the Main Building, South Warehouse, small shed, three storm water retention ponds, spill containment pond, storm sewers, and sanitary sewers. In 1982, Martha C. Rose Chemicals, Inc. (Rose) began processing polychlorinated biphenyls (PCBs) and PCB-contaminated equipment. Rose had been granted approvals by the U.S. EPA under the Toxic Substances Control Act (TSCA) to decontaminate PCB-contaminated mineral oil dielectric fluids and to process PCB electrical equipment for disposal. Rose failed to manage the PCB materials according to federal regulation and ceased operation in February, 1986. Approximately 14 million pounds of PCB materials were abandoned at the Site.

The Rose Chemicals Steering Committee (RCSC) entered into two Administrative Orders on Consent with the U.S. EPA. The RCSC carried out preliminary assessments of the Site; secured the Site; inventoried and removed PCBs and PCB materials from the Site; and authorized a Remedial Investigation/Feasibility Study (RI/FS) of the Site. The RI found PCBs in on-site surface and subsurface soils, in off- and on-site surface water sediments, in on- and off-site surface waters, and in the on-site buildings and concrete floors. PCBs were found in the shallow groundwater of two on-site monitoring wells. Tracking of PCBs off of the Site was shown to be insignificant. Low levels of volatile organic compounds (VOCs) were found in the subsurface soils, shallow groundwater, sediments, and surface waters.

The RI finds no known environmentally important habitats or sensitive environments. There are no known threatened, endangered, or rare species in the immediate area. The available data indicate no known risks to terrestrial wildlife, livestock, terrestrial vegetation, or aquatic life.

The RI also identified three future use scenarios - no action, industrial development, and residential development. There are unacceptable potential health risks due to PCBs under current conditions in all three scenarios. The media of interest are sediments, on-site soils, building surfaces, shallow groundwater, and surface water.

B. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

In order to identify applicable technologies, response action objectives and associated allowable exposure levels are developed based on evaluations of acceptable health risks, use scenarios, and conformance with chemical-specific ARARs. Current conditions are determined to be acceptable for groundwater and surface water. Allowable PCB exposure levels for other Site media are as follows:

o Soils - Use of the Site for residential development requires that the PCB levels in the soil be reduced to 0.35 ppm based on health risk due to PCB vapors concentrating in unventilated buildings. A potential option to soil PCB concentration reduction would be to provide ventilation systems for residential buildings to prevent concentration of PCB vapors. All use scenarios require that humans not be exposed to soils with more than 10 ppm PCBs based on the PCB Spill Cleanup Policy.

- Sediments - On- and off-site stream sediment PCB concentrations need to be reduced to 1.8 ppm based on health risk for all scenarios.

- Buildings and Concrete - Building wall PCB levels need to be reduced to 4.1 $ug/100cm^2$. Floors require cleaning to below detection limits for the industrial development scenario. The concern with use of the existing buildings and detectable concentrations of PCBs in the floor is inhalation of PCB vapors.

Volumes and areas of PCB materials are estimated using information developed during the RI, allowable exposure levels and response action objectives.

General response actions and technologies are identified and initially screened. After applicable general response actions and technology types are identified, technology process options are screened based on their general applicability. The process options are then evaluated for their effectiveness, implementability, and cost, resulting in a list of feasible process options.

C. DEVELOPMENT AND SCREENING OF ALTERNATIVES

Eight alternatives, consisting of previously identified feasible process options, have been developed to address the media of interest. These alternatives are:

- Alternative 1 - No action. Access to the Site is prohibited and no use of the Site in the foreseeable future is allowed.
- Alternative 2 - Remove off-site PCB sediments only. Access to the Site is prohibited and no use of the Site in the foreseeable future is allowed.
- Alternative 3 - Remove off- and on-site PCB sediments and cap Site. Access to the Site is prohibited and no use of the Site in the foreseeable future is allowed.
- Alternative 4 - (Options A & B) Remove off- and on-site PCB sediments; remove or cap Site soils; clean concrete and buildings. The Site buildings are available for light industrial use. Option A caps the Site soils (>10 ppm PCBs) while Option B removes them.
- Alternative 5 - Remove PCB sediments; remove buildings; cap Site. The Site is available for light industrial use.

- Alternative 6 - (Options A & B) Remove PCB sediments, remove or cap Site soils; clean buildings; and remove concrete. The Site buildings are available for light industrial use. Option A caps the Site soils (>10 ppm PCBs) while Option B removes them.

- Alternative 7 - Remove PCB sediments, soils (>10 ppm PCBs), buildings, and concrete. Future building on the Site is restricted to industrial type buildings.

- Alternative 8 - Remove PCB sediments, soils (>0.35 ppm PCBs), buildings, concrete, and sewers. Access and future use of the Site are unlimited.

The screening process eliminated Alternative 2 because of ineffectiveness.

D. DETAILED ANALYSIS OF ALTERNATIVES

The detailed analysis of alternatives includes three sections - a more detailed description, an assessment of each alternative based on evaluation criteria, and a comparative analysis of the alternatives. The nine evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment

- o Short-term effectiveness
- o Implementability
- o Cost
- o State acceptance
- o Community acceptance

The first two criteria are threshold criteria that must be satisfied for an alternative to be accepted. The following five criteria are primary criteria and are the basis of analysis for the other concerns - institutional, technical, risk, and cost. The last two criteria, state acceptance and community acceptance, will be assessed following public and regulatory comment on the FS.

Alternatives 1 and 3 are not acceptable alternatives due to lack of protection of health and environment and long-term effectiveness. The remaining alternatives meet the primary criteria in varying degrees. Costs for each alternative are estimated using both off-site incineration and off-site landfilling as the ultimate disposal means. In the preliminary cleanup work at the Site, approximately 61 percent of the materials removed from the Site were incinerated, resulting in the destruction of nearly 491,000 pounds of PCBs or approximately 99.2 percent of all PCBs on-site when the RCSC took control. Therefore, the statutory preference for treatment has been met. Most materials still to be removed from the Site are of low PCB concentrations. Thus, off-site landfilling is the disposal method of choice.

I'm uncertain if this logic is sound

The present-worth costs, assuming 5 percent discount rate for 30-years of O&M, are given in order of ascending costs as follows:

Alternative	Total Present Worth Costs ($ Million)*
5 (Cap)	5.84
4A (Cap)	6.95
6A (Cap)	8.55
4B (Remove)	9.05
7 (Remove)	11.53
6B (Remove)	12.25
8 (Remove)	102.1

* Based on landfilling those PCB materials removed. Costs are as of September 1989.

Of these alternatives, the three lowest cost ones are "capping" alternatives (where the Site soils >10 ppm PCBs are primarily capped) and the remainder are "removal" alternatives (where the Site soils >10 ppm PCBs are removed).

Alternative 5 removes PCB sediments and buildings and caps the soil (>10 ppm PCBs) and concrete. The other two capping alternatives 4A & 6A leave the existing buildings. Because there is no advantage in leaving the buildings and those alternatives are more expensive, Alternative 5 is the best choice of the capping alternatives.

Of the removal alternatives, Alternative 4B is the least costly. This alternative cleans the buildings and the concrete. The cleaning process is iterative in nature. Since the concrete is porous, the number of iterations could be high. At some point, the cleaning process may equal the removal cost. Alternative 6B removes the concrete instead of attempting to clean it, which provides an indication of that cost range. Because of the uncertain nature and effectiveness of the concrete cleaning, Alternative 4B is dropped from consideration.

Alternative 7 removes the buildings and concrete. New structures on the Site are limited to industrial type buildings. Alternative 6B is more expensive than Alternative 7 but leaves the buildings on-site. With the buildings remaining on-site, there is a potential for future response requirements and also for removal if they fall into disrepair. Consequently, Alternative 6B is dropped from consideration.

Alternative 8 is about 10 times more expensive than Alternative 7. However, Alternative 8 does not provide any significant benefit for the substantial increase in cost. Therefore, Alternative 7 is the best choice of the removal alternatives.

The basic difference between Alternatives 5 and 7 is that Alternative 7 removes the materials containing PCBs from the Site while Alternative 5 secures them on-site.

* * * * *

PART I

INTRODUCTION

A. PURPOSE AND ORGANIZATION

This report presents findings of the Feasibility Study (FS) for the Rose Chemicals Site (Site) in Holden, Missouri. This document is prepared in accordance with the U. S. EPA-approved Final Work Plan for Remedial Investigation/Feasibility Study at Rose Chemicals Site in Holden, Missouri, ERT Engineering Company, June 30, 1988 (Final Work Plan).

The purpose of this report is to identify and evaluate response alternatives which reduce the volume, toxicity, or mobility of the identified site contaminants as defined by the Report on the Remedial Investigation of the Rose Chemicals Site, Holden, Missouri, Burns & McDonnell Engineering Company, August, 1989 (RI Report). The evaluated alternatives protect human health and welfare, and the environment, and they encompass a wide range of remedial options as suggested by Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, U.S. EPA, October 1988 (EPA Guidance).

The report is organized into four parts. The remainder of Part I presents the report organization and Site background information, including the extent of contamination of the Site as summarized from the RI Report.

Technologies are identified and screened in Part II. Initially, the response action objectives are developed to address the compounds of interest. The objectives developed provide acceptable exposures as established by application of the risk assessment models developed in the RI Report, Part V - Endangerment Assessment (EA), and by ARARs. General response actions which satisfy the response action objectives are then developed for each medium of interest. Volumes or areas of those media are estimated. Finally, applicable technology types and process options are identified and screened.

In Part III, a range of potential alternatives, using the technologies selected in Part II, is developed. The alternatives vary from a "No Action" alternative as suggested by EPA Guidance to an alternative which allows unrestricted future Site use and access. Each alternative is described and screened based upon effectiveness and implementability. Cost is not a factor in the alternative screening.

Part IV is the detailed analysis of the screened alternatives. The analysis consists of three parts:

- o Detailed description of the alternatives.
- o An assessment of each alternative based on the nine EPA criteria.
- o A comparative analysis of the alternatives.

Based on the comparative analysis, an alternative for implementation is recommended.

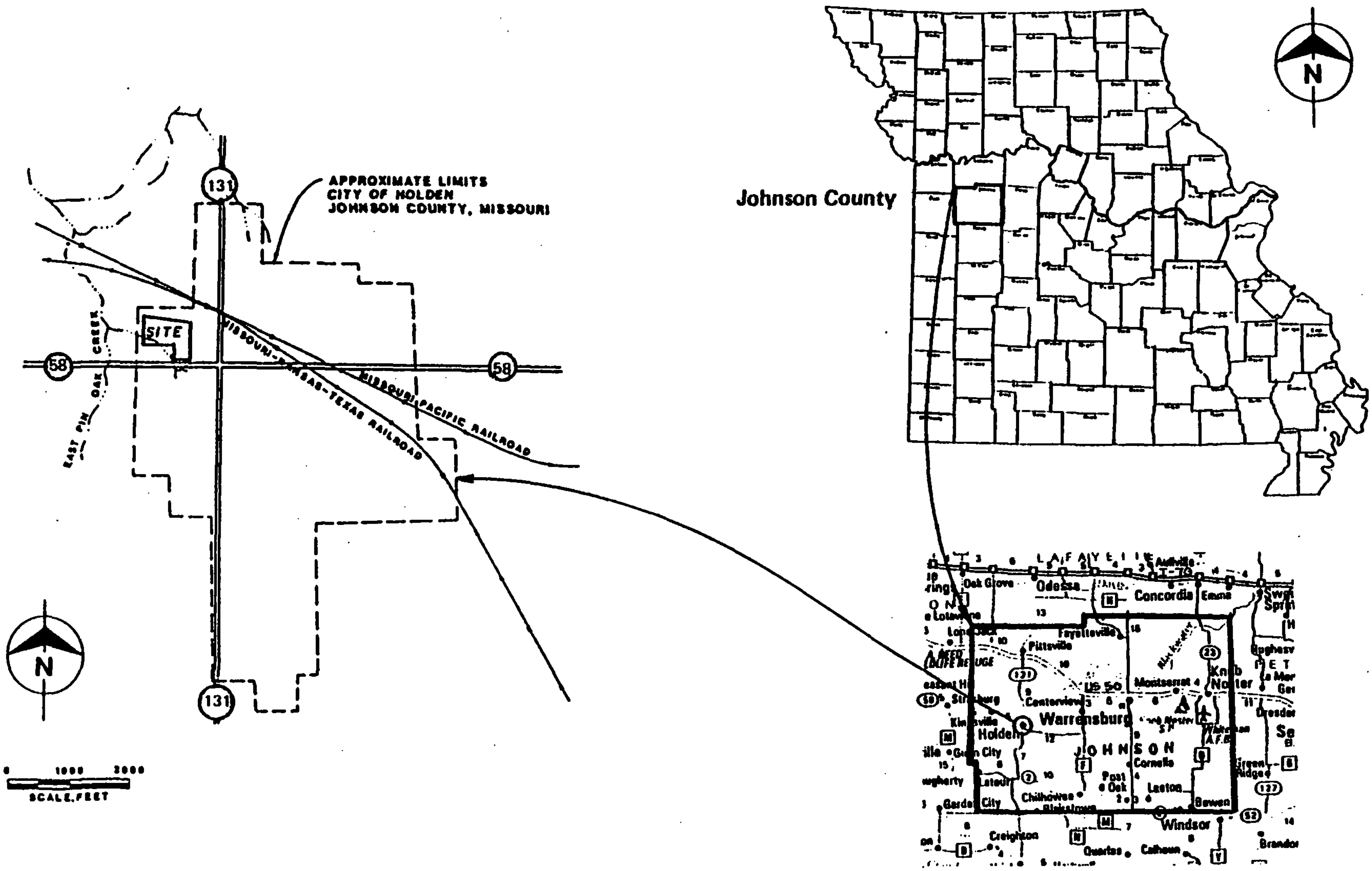
B. SITE BACKGROUND INFORMATION

1. SITE DESCRIPTION

The Site is located at 500 West McKissock Street, immediately north of Missouri Highway 58, in Holden, Missouri (see Figure I-1). Holden is approximately 50 miles southeast of Kansas City, Missouri. The approximately 13-acre Site contains two major buildings, the Main Building and the South Warehouse (combined floor area greater than 100,000 sq. ft.), a small shed, and spill and storm water containment ponds. An intermittent unnamed tributary to East Pin Oak Creek flows through the southwest corner of the Site. Figure I-2 presents the Site layout, including active and abandoned sewers and selected monitoring wells.

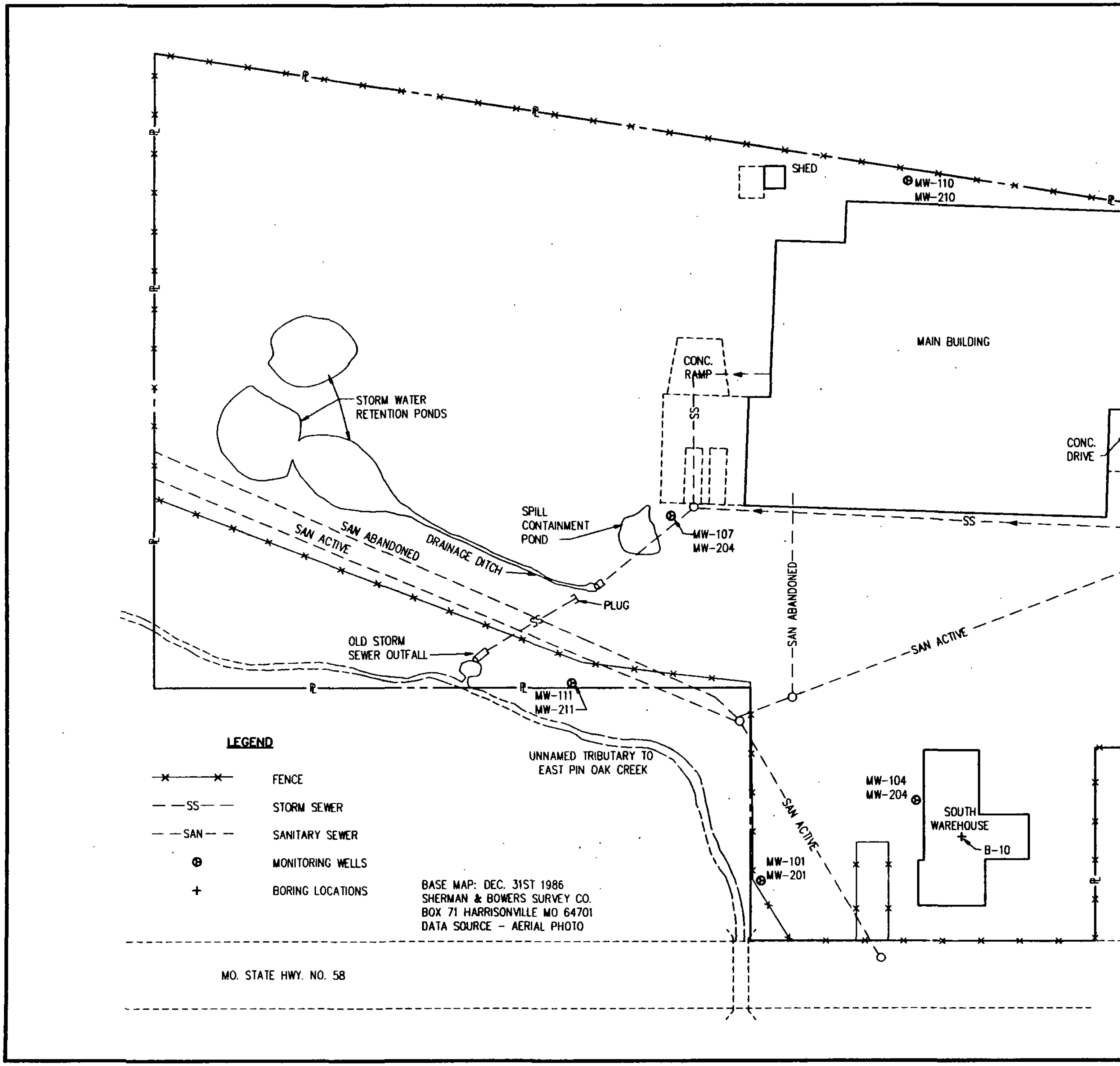
2. SITE HISTORY

The Site is owned by the City of Holden and was previously known as the Holden Industrial Park. The South Warehouse was built in the late 1940s, and International Harvester is believed to have initially used it as a shop. The Main Building was constructed in stages in the 1960s. Royal Industries, Inc. was the first company to lease the Site with the Main Building, having entered into a lease with the City on June 1, 1976. Lear Siegler, Inc. in early 1977 acquired the stock of Royal and in June, 1977, Royal was merged into Lear with the result that Lear succeeded to Royal's interest under the lease. Royal operated a farm implement assembly and painting operation at the Site until early 1980. In December 1979, Lear entered into a sublease with W.C. Carolan Company, Inc. and assigned Lear's option to purchase the Site to Carolan.



Burns & McDonnell

ROSE CHEMICALS SITE
Figure I-1
SITE LOCATION
(LOCUS MAP)



ROSE CHEMICALS SITE

FIGURE 1-2
SITE LAYOUT

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Carolan's first PCB handling company was named PCB Eliminators, which was a transfer facility and was in business for approximately one year. In 1982, Rose began processing PCBs and PCB-contaminated equipment, although, so far as has been determined, there was no written sublease or assignment between Carolan and Rose. Carolan was one of several companies all operating at the Site under the same ownership, primarily that of Mr. Walter C. Carolan, which included: Dust Suppression, Inc.; American Steel Works, Inc.; as well as W. C. Carolan Company, Inc. and Rose.

Rose operated on-site from 1982 to February 1986. Rose had been granted approvals by the U.S. EPA under TSCA to decontaminate PCB-contaminated mineral oil dielectric fluids and to process PCB electrical equipment for disposal. During the Rose operation, approximately 23 million pounds of PCB materials were received at the Site. Rose failed to manage the PCB materials according to applicable federal regulations or U.S. EPA agreements or orders and subsequently ceased operations in February 1986. Approximately 14 million pounds of PCB materials were abandoned at the Site.

Since then, the RCSC has entered into two Administrative Orders on Consent (AOCs) with U.S. EPA, Region VII. In accordance with these AOCs, the RCSC has carried out preliminary assessments of the Site; secured the Site; inventoried and removed 16 million pounds of PCBs, PCB materials, and PCB debris from the Site; removed 3.6 million pounds of PCB-containing soil from the Site; and is currently conducting a

RI/FS of the Site. Approximately 61 percent of the materials from the Site were incinerated, resulting in the destruction by incineration of an estimated 491,000 pounds of PCBs.

3. NATURE AND EXTENT OF CONTAMINATION

Environmental samples taken during the RI activities were analyzed for PCBs, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs), or for PCBs only, depending upon the media. SVOCs rarely were detected in significant quantities. Therefore, the conclusions presented below address PCBs and VOCs.

a. Exterior Subsurface Soils

- The major PCB concentrations were found in the soil adjacent to and under the Site storm and sanitary sewers serving the Main Building at concentrations up to 700 ppm total PCBs. PCB concentrations of less than 1 ppm were also detected along the Holden sanitary sewer line.

- Other PCBs detected in the subsurface tend to be found in the proximity of the buildings and the upper part of the overburden soil.

- VOCs in concentrations up to 9.4 ppm (total) were found in the soil around the Holden sanitary sewer and are thought to originate from leakage of the sanitary sewers.

- o The source of VOCs found in the borehole for MW-104 (maximum concentration of 0.74 ppm total VOCs) is likely to be a suspected former degreasing pit in the South Warehouse. VOCs found in the borehole for MW-110 (maximum concentration of 0.08 ppm total VOCs) are likely due to VOC-containing liquid waste which was assumed to have been released in the vicinity of this boring (the north door of the Main Building). The source of VOCs found in the borehole for MW-111 (maximum concentration of 0.37 ppm total VOCs) is likely to be the same as the VOCs found around the sanitary sewers.

b. <u>Interior Subsurface Soils</u>

- o PCB concentrations (maximum of 18.5 ppm) were detected beneath the Main Building. PCBs were detected in one soil sample from Boring B-10 in the South Warehouse at a total concentration of 0.3 ppm.

- o VOCs were detected in samples from under both buildings and were variable (maximum concentration of 3.325 ppm total VOCs), corresponding to areas where suspected VOC releases may have taken place.

- o Due to the low permeability of the soil, PCBs and VOCs were found mainly in the upper few feet of the overburden soil beneath the floor slabs of the buildings.

c. Groundwater

- o Sampling procedures in groundwater sampling rounds 1 and 2 were suspected to have resulted in low-level PCB contamination of groundwater samples from ground level dust containing PCBs. Increased efforts were made during groundwater sampling in round 3 to avoid dust contamination of the samples. The third round of groundwater sampling has been judged to provide the most representative data on PCB concentrations in groundwater at the Site. PCBs were detected in round 3 in groundwater only from shallow wells MW-207 (0.0225 ppm) and MW-204 (0.0013 ppm).

- o *VOCs were detected in samples collected during all three* groundwater sampling rounds from shallow wells MW-201, MW-204, MW-210, and MW-211. The likely source of VOCs in samples from MW-201 and MW-204 is the upgradient former degreasing pit in the South Warehouse. VOCs in samples from MW-210 are likely to be the result of previous releases of VOC liquid waste in the area of MW-210. VOCs in samples from MW-211 likely reflect water leakage from the nearby sanitary and/or storm sewers to the groundwater.

- o After purging, no PCBs were detected in the groundwater samples taken from the two shallow wells located on the Anderson property adjacent to the Site.

d. Surface Soils

No mention of 3.6 million Pounds of Soil Removed

- Surface soils exhibiting PCB concentrations of 10 ppm or higher are located around the Main Building and the South Warehouse, in the area between the two buildings, and in the area to the west of both buildings. These areas represent less than 10% of the total Site area. The highest concentration (540 ppm) of PCBs is found immediately to the southwest of the South Warehouse.

- Transport of PCBs by soil erosion at the Site is minimal. A small amount of erosion is occurring in the areas south and west of the Main Building. The small amount of soil eroded from these areas is deposited either in the southern portion of the Site or in the storm water retention ponds.

e. Surface Tracking

- PCBs were detected at levels up to 0.1 ppm in surface soil samples obtained just north of the Site at a little-used access gate.

- PCBs were detected at levels up to 6.1 ug/100 cm^2 on asphalt roads just off-site at the east and south Site access gates.

f. Sediments

- PCB concentrations ranging from 0.3 to 122 ppm were detected in sediments in on-site surface water bodies.

- No PCBs were detected in the sediment samples taken from the Holden sanitary sewer line. VOCs were detected in the sewer sediment at levels up to 11 ppm (toluene) and appear to be from an off-site source.

- Trichloroethene was found in the unnamed tributary in concentrations up to a maximum of 0.053 ppm. Concentrations of trichloroethene generally decreased from east to west from the maximum, located off-site south of Missouri Highway 58, to 0.008 ppm near the confluence of the unnamed tributary and East Pin Oak Creek. In the off-site downstream reach of the unnamed tributary, 6 of the 9 samples taken were below detection limit for trichloroethene, and the maximum concentration was 0.008 ppm. A potential on-site source of trichloroethene is the suspected former degreasing pit in the South Warehouse.

- PCBs were detected at a concentration of 77 ppm in a sediment sample taken at the confluence of East Pin Oak Creek and its unnamed tributary. Four sediment samples taken in a reach of the creek between 200 and 500 feet downstream of the Holden POTW outfall exhibited PCB concentrations up to 293 ppm. No PCBs were detected in the sediment samples obtained more than 500 feet downstream of the POTW. The PCBs are thought to be either residual deposits of PCB-laden sediment or PCB-laden sludge from the POTW.

- o Xylenes and toluene were detected in 2 and 7, respectively, of 17 sediment samples from East Pin Oak Creek. Because only minor amounts of toluene were found on-site (except in the Holden sanitary sewer sediment) and no pathways for off-site movement of xylenes were found, an off-site source of these chemicals is probable.

g. Surface Water

- o PCBs were detected in the two samples from the on-site spill containment pond at a maximum concentration of 0.010 ppm. Ethanol was the only VOC detected (at 0.016 ppm) in these samples. No PCBs or VOCs were detected in the storm water retention ponds.

- o PCBs were detected in samples taken from the main pit in the Main Building at concentrations between 3.5 and 4.5 ppm. VOCs were also detected in these samples at concentrations ranging between 0.712 and 1.134 ppm. These contaminants appear to be a result of residues leaching from the concrete walls of the pit.

- o VOCs and PCBs were detected at maximum concentrations of 0.078 ppm and 0.0039 ppm, respectively, in surface water samples from the unnamed tributary. Desorption from the stream sediments is probably the source of the detected contaminants.

- VOCs and PCBs were detected at maximum concentrations of 0.057 ppm and 0.0065 ppm, respectively, in surface water samples from East Pin Oak Creek. The source is probably desorption of the contaminants from sediments.

h. Air

- Airborne dust samples obtained during on-site investigations did not contain detectable concentrations of PCBs.

i. Buildings and Structures

- The concrete floors contain the highest PCB concentrations of any on-site building or structure surface. In some areas PCBs have been absorbed by the concrete and are present in concentrations greater than 100 ppm to a depth of 2 inches.

- PCB concentrations detected at unbiased locations on interior wall, horizontal, and ceiling surfaces range from below detection limit to 830 ug/100 cm^2. At biased locations, the PCB concentrations ranged from below detection limit to 1,180 ug/100 cm^2.

- The PCB concentrations detected on exterior building surfaces were all below 10 ug/100 cm^2 except for one wipe sample which exhibited a PCB concentration of 19.9 ug/100 cm^2.

- Visibly stained surfaces generally exhibit higher concentrations of PCBs.

- The Main Building exhibits higher absolute concentrations of PCBs than the South Warehouse.

4. RISK ASSESSMENT

As part of the RI, an Endangerment Assessment (EA) was performed in accordance with U.S. EPA guidance to assess the potential risks to public health, welfare, and the environment associated with the potential release of chemicals at the Site. Pathways by which a population or an individual could be exposed to chemicals originating from the Site under current or hypothetical future uses of the site were evaluated. For each pathway considered, "typical" and "reasonable worst" case exposures were calculated. Because of the generally conservative assumptions that underlie both the toxicity criteria and exposure estimates, the estimated potential risks for both the typical and reasonable worst case are almost certainly greater than the actual risks.

Both carcinogenic and noncarcinogenic health risks were estimated in the EA. In interpreting cancer risk estimates, Superfund guidance considers the target total individual carcinogenic risk resulting from exposure at a Superfund site to fall in the range of 10^{-4} to 10^{-7} (Superfund Public Health Evaluation Manual, U.S. EPA, 1986a). For noncarcinogenic effects, a target exposure is when the chemical dose does not exceed the reference dose for any exposure pathway. Because potential carcinogens usually drive the design process, U.S. EPA guidance recommends that target concentrations first be set for carcinogens. These concentrations are then checked to verify that they result in acceptable noncarcinogenic risks.

For purposes of the FS, a target allowable or acceptable exposure is assumed to result in less than a 10^{-5} upper bound excess lifetime cancer risk level for each exposure pathway using typical case assumptions. These exposures will be further evaluated if total exposure for any receptor results in an excess lifetime cancer risk greater than a 10^{-4}.

Furthermore, for noncarcinogenic effects, these exposures will be checked if the chemical dose exceeds the reference dose for any exposure pathway.

The major findings of the EA are as follows:

- o Eleven indicator chemicals (contaminants) were selected for the Site based upon their frequency of detection, concentration, toxicity, mobility, and persistence. They are Aroclor 1242, Aroclor 1254/1260, 1,1-dichloroethane, 1,1-dichloroethene, g-hexachlorocyclohexane (lindane), methylene chloride, tetrachloroethene, toluene, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, and trichloroethene.

- o Chemical concentrations are above potential ARARs in some samples of sediment, on-site soils, surface water, groundwater, and building surfaces. No potential ARARs were identified for ambient air.

- There are no known environmentally important habitats or sensitive environments on or near the Site. There are no known threatened, endangered, or rare species on or near the Site. The available data indicate no known risks to terrestrial wildlife, livestock, terrestrial vegetation, or fish life on or near the Site.

- Three future use scenarios are identified. They are: no action, industrial development, and residential development. Exposure pathways were developed based on these scenarios. For all scenarios considered, both carcinogenic and noncarcinogenic risks are primarily due to PCBs.

Tables I-1 and I-2 present the excess cancer risks and noncarcinogenic risks, respectively, for the three scenarios. The potential unacceptable risks for a typical case exposure are summarized for each scenario as follows:

- No Action
  - On-Site cancer risks to the trespasser are unacceptable for dermal contact with the existing building floors and for indoor vapor inhalation (existing buildings). The unacceptable noncancer risks are due to the same pathways.

  - Off-Site cancer risks to the off-site resident are unacceptable only for beef ingestion. Unacceptable noncancer risks are also limited to beef ingestion.

- Industrial Development
  - On-Site cancer risks to the future industrial worker are unacceptable for dermal contact with the existing building floors and walls and for vapor inhalation (existing buildings). The unacceptable noncancer risks are due to dermal contact with the floors and to indoor vapor inhalation.

  - Off-Site cancer risks to the off-site resident are unacceptable only for beef ingestion. Unacceptable noncancer risks are also limited to beef ingestion.

- Residential Development
  - On-Site cancer risks are unacceptable to the future on-site resident for beef ingestion and for indoor vapor inhalation (new building). The unacceptable noncancer risks are due to the same pathways.

  - Off-Site cancer risks to the off-site resident are unacceptable for beef ingestion. The unacceptable noncancer risks are due to the same pathway.

TABLE I-1

SUMMARY OF EXCESS UPPER-BOUND LIFETIME CANCER RISKS FOR TYPICAL CASE

	No Action[a] (Current Use)		Industrial Development	Residential[c] Development
Pathway	Off-Site Resident	On-Site Trespasser	On-Site Worker	On-Site Resident
Soil ingestion (Adult)	1.0×10^{-7}	4.3×10^{-8}		2.5×10^{-7}
Soil ingestion (Child)	1.5×10^{-6}			3.7×10^{-6}
Soil, dermal	9.9×10^{-8}	8.2×10^{-8}		2.5×10^{-7}
Wading, dermal	6.9×10^{-7}	1.0×10^{-6}		6.9×10^{-7}
Particulate, inhalation	2.2×10^{-8}	2.1×10^{-10}		1.9×10^{-8}
Vapor, inhalation, outdoor	1.0×10^{-5}	9.9×10^{-8}	1.5×10^{-7}[d,e]	
Vapor, inhalation, indoor, new building			7.0×10^{-6}[d,f]	6.2×10^{-5}
Beef, ingestion	1.3×10^{-4}			1.3×10^{-4}
Vegetable, ingestion	2.4×10^{-6}			5.5×10^{-6}
Sediment, ingestion	7.7×10^{-7}	2.0×10^{-7}		7.7×10^{-7}
Sediment, dermal	1.8×10^{-6}	4.6×10^{-7}		1.8×10^{-6}
Existing building, vapor inhalation		1.6×10^{-5}	3.8×10^{-3}[b]	
Existing building, floor, dermal		6.0×10^{-5}	1.7×10^{-3}[b]	
Existing building, wall, dermal		1.7×10^{-6}	4.9×10^{-5}[b]	

Notes:

[a]Assumes no changes to current site condition.

[b]Assumes existing buildings (without cleanup) are used by future worker who spends majority of work day indoors.

[c]Assumes that only the buildings, concrete, and ponds are removed.

[d]New value calculated for the FS. See Appendix A for support detail.

[e]Assumes that the existing buildings are removed and that the PCB soils (>10 ppm) and existing concrete slabs are capped (See Appendix A).

[f]Assumes use of a warehouse type building with a 20-foot ceiling and a ventilation rate of 1 ach (See Appendix A).

TABLE I-2

SUMMARY OF MDD/RfD RATIOS FOR NONCARCINOGENIC EFFECTS FOR TYPICAL CASE

Pathway	No Action[a] Current Use: Off-Site Resident	No Action[a] Current Use: On-Site Trespasser	Industrial Development: On-Site Worker	Residential[c] Development: On-Site Resident
Soil, ingestion (adult)	7.6×10^{-3}	2.8×10^{-2}		1.9×10^{-2}
Soil, ingestion (child)	7.4×10^{-2}			1.8×10^{-1}
Soil, dermal	7.5×10^{-3}	4.5×10^{-1}		1.9×10^{-2}
Wading, dermal	8.2×10^{-2}	5.1×10^{-1}		8.2×10^{-2}
Particulate, inhalation	2.4×10^{-4}	5.9×10^{-5}		2.0×10^{-4}
Vapor, inhalation, outdoor	4.5×10^{-1}	1.2×10^{-1}	2.2×10^{-3}[d,e]	
Vapor, inhalation, indoor, new building				$1.4\times10^{+1}$
Beef, ingestion	1.4			1.4
Vegetable, ingestion	2.6×10^{-2}			5.9×10^{-2}
Sediment, ingestion	1.1×10^{-1}	1.3×10^{-1}		1.1×10^{-1}
Sediment, dermal	2.3×10^{-1}	2.7×10^{-1}		2.3×10^{-1}
Existing building, vapor, inhalation		8.8	$5.4\times10^{+1}$[b]	
Existing building, floor, dermal		$3.1\times10^{+1}$	$2.4\times10^{+1}$[b]	
Existing building, wall, dermal		8.7×10^{-1}	6.9×10^{-1}[b]	

Notes:

[a]Assumes no changes to current site condition.
[b]Assumes existing buildings (without cleanup) are used by future worker who spends majority of work day indoors.
[c]Assumes that only the buildings, concrete, and ponds are removed.
[d]New value calculated for the FS. See Appendix A for support detail.
[e]Assumes that the existing buildings are removed and that the PCB soils (>10ppm) and existing concrete slabs are capped (See Appendix A).

Based on this analysis, the media of interest identified by the EA are summarized in Table I-3.

TABLE I-3

MEDIA OF INTEREST
IDENTIFIED BY THE ENDANGERMENT ASSESSMENT

A. Health-Based Media of Interest

Medium	Affected Scenario	Pathway
1. Stream Sediments	All	Beef Ingestion
2. Site Buildings - Floors	No Action Industrial Development	Dermal Dermal
3. Site Buildings	No Action Industrial Development	Inhalation Inhalation
4. Site Buildings - Walls	Industrial Development	Dermal
5. Site Soils	Residential Development	Inhalation

B. Potential ARAR-Based Media of Interest

1. Sediments
2. Site Soils
3. Site Building Surfaces
4. Shallow Groundwater
5. Surface Waters

* * * * *

PART II

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

A. INTRODUCTION

This Part establishes response action objectives for each medium of interest; estimates areas and volumes for each medium; and identifies, screens, and evaluates response technologies.

B. RESPONSE ACTION OBJECTIVES

1. GENERAL

Response action objectives define the allowable exposures to compounds of interest found in the various Site media. The objectives are based on: (1) use scenarios, (2) acceptable human health risks as determined by the application of the risk assessment models developed in the EA and (3) conformance with chemical-specific ARARs.

In this study, three use scenarios for the Site are evaluated. The first is the no action scenario where the Site is not available for use. The second scenario, industrial development, is where the existing buildings and grounds are remediated sufficiently to allow the buildings to be used for light industrial applications or the existing buildings are removed and replaced with new buildings. The future on-site worker is assumed to spend the majority of the work day indoors. The third scenario, residential development, is where Site development is unrestricted.

These scenarios, no action, industrial development, and residential development, were evaluated in the EA. The EA concluded for all scenarios that the Site posed no known risks to terrestrial wildlife, livestock, terrestrial vegetation, or aquatic life. Therefore, the response action objectives are based on human health risks only.

The compounds of interest include only PCBs and VOCs. The human health objectives are limited to PCBs because the EA concluded that human health risks are primarily due to PCBs. It was found that PCBs contributed at least 99 percent of the total excess cancer risk in 56 of the 58 exposure scenarios analyzed and 96 percent or more of the total excess cancer risk in all 58 exposure scenarios. PCBs similarly were found to pose the highest potential for adverse noncarcinogenic effects. Additional human health-based risk information was developed for the FS and is presented in Appendix A.

The following media of interest were selected based on the EA findings:

- o Site Soils
- o Sediments
- o Site Buildings
- o Surface Waters
- o Shallow Groundwater

Each of these media is discussed in subsequent sections.

2. SITE SOILS

The Site soils are characterized based on the RI findings as follows:

- Surface Soils - The compounds of interest are PCBs. The PCBs are localized in relatively small areas and to a depth of 0-3 inches.

- Exterior Subsurface Soils - The compounds of interest are PCBs and VOCs which are generally located near the Main Building and the South Warehouse and around on-site sanitary and storm sewers.

- Interior Subsurface Soils - The compounds of interest are PCBs and VOCs which are generally located beneath the Main Building and South Warehouse.

a. Allowable Exposure Based on Human Health Risk Assessment

Current soil PCB concentrations are acceptable for all scenarios except residential development. For the residential development scenario, the on-site resident has unacceptable excess cancer risks ($>10^{-5}$) for vapor inhalation (indoor), and also the noncancer risk potential for vapor inhalation (indoor) is greater than 1. Both risks are unacceptable because of PCB concentration in soils.

The EA exposure models then were used to calculate soil concentrations which would yield acceptable excess cancer risks ($<10^{-5}$) or acceptable risk for noncarcinogenic effects (MDD/RfD<1.0) for the residential development scenario. The results are in Table II-1. For this scenario to have an acceptable excess cancer risk of less than 10^{-5}, the average concentration of PCBs in soil must be reduced from the existing 4.86 to 0.78 ppm. To reduce noncancer risks to an acceptable level, the average soil PCB concentration must be reduced to 0.35 ppm. The risk equations are generally linear; therefore, acceptable PCB concentrations can be related to existing concentrations by the ratio of acceptable risk (10^{-5} for excess cancer risk) to current risk. For example, the current cancer risk for vapor inhalation from soils is 6.2×10^{-5} (Part I). The acceptable soil PCB concentration then is equal to 4.86 ppm x ($1.0 \times 10^{-5}/6.2 \times 10^{-5}$) = 0.78 ppm.

TABLE II-1

ACCEPTABLE SOIL PCB CONCENTRATIONS - HUMAN HEALTH BASIS

			PCB Concentration (ppm) Typical Case	
Scenario	Risk	Pathway	Current	Acceptable Risk
Residential Development	Cancer	Vapor	4.86	0.78
Residential Development	Noncancer	Vapor	4.86	0.35

The EA exposure models also predict that average acceptable soil PCB concentrations will increase with time. For carcinogenic risks the increase is relatively slow, and the reduction factor is 2.9 after 15 years. However, for noncarcinogenic risks the reduction factor after 15 years is 56. Therefore, if residences were only allowed to be built on the Site after 15 years, the average current soil PCB concentration associated with acceptable cancer and noncancer risks would be 2.26 ppm (0.78 x 2.9) and 19.6 ppm (0.35 x 56), respectively. Additional discussion of time impacts on PCB emission rate is included in Appendix A.

b. Allowable Exposure Based on Potential ARARs

(1) PCBs: Appendix B includes an analysis of potential ARARs concerning PCBs. Only one chemical-specific ARAR was identified for PCBs - Title 40, Code of Federal Regulations (CFR), Part 761.125 (PCB Spill Cleanup Policy). These guidelines are not applicable to the Site because spills occurring before May 4, 1987 are specifically exempted. In addition, the PCB Spill Cleanup Policy is believed to be generally not relevant to the conditions present at the Site. The policy was established to regulate cleanup of a defined individual PCB spill soon after its occurrence. The conditions present at the Site are the result of undefined releases in undefined areas of the Site over a period of years. However, the science and health input into the numerical standards contained in the policy is independent of the conditions or means of PCB release. Therefore, the numerical cleanup standards contained in the PCB Spill Cleanup Policy are believed to be relevant and appropriate for establishing numerical exposure standards for remediation of the Site. The PCB Spill Cleanup Policy limits soil PCB concentrations for nonrestricted access areas to 10 ppm PCBs (by weight).

(2) VOCs: No chemical-specific ARARs on VOCs in soils have been found.

c. Response Action Objectives

- For human health effects, prevent inhalation of soil PCB vapors having unacceptable ($>10^{-5}$) excess cancer risk or having the potential for adverse noncarcinogenic effects (MDD/RfD>1.0) in typical exposures.

- For compliance with chemical-specific ARARs, prevent exposure to Site soils with more than 10 ppm PCBs.

3. SEDIMENTS

The on-site sediments of interest are in the spill containment pond, storm water retention ponds, and the drainageways. Off-site sediments containing PCBs and VOCs were found in East Pin Oak Creek and its unnamed tributary. The principal compounds of interest are PCBs. VOCs found in East Pin Oak Creek and the unnamed tributary are believed to be primarily from off-site sources with a minor contribution from on-site sources.

a. Allowable Exposure Based on Human Health Risk Assessment

The EA found that the excess cancer risks due to exposure to sediments for the no action scenario via the dermal and ingestion pathways are acceptable ($<10^{-5}$). The adverse noncarcinogenic effects for the no action scenario are acceptable (MDD/RfD<1.0) for ingestion and dermal pathways.

The industrial development and residential development scenarios do not apply because on-site sediment ingestion and dermal contact pathways are assumed not to exist.

The EA found that sediments containing PCBs indirectly yield unacceptable risks in both the cancer and noncancer categories due to potential ingestion of contaminated beef. The EA modelled home grown beef cattle raised on drinking water which contained suspended sediments from East Pin Oak Creek and the unnamed tributary. The cattle owners subsequently consumed the beef on a regular basis. This pathway yields an unacceptable excess cancer risk ($\geq 10^{-5}$) and an unacceptable risk (>1.0) for adverse noncarcinogenic effects.

The EA exposure models are used to calculate sediment PCB concentrations which would yield acceptable excess cancer risks or acceptable noncancer risks. The results are presented in Table II-2.

TABLE II-2

ACCEPTABLE SEDIMENT PCB CONCENTRATIONS - HUMAN HEALTH BASIS

			PCB Concentrations (ppm) Typical Case	
Scenario	Risk	Pathway	Current	Acceptable Risk
No Action (Off-Site Resident)*	Cancer	Beef Ingestion	23.4	1.8
No Action (Off-Site (Resident)*	Noncancer	Beef Ingestion	23.4	16.7

*Also applies to residential development scenario.

The data indicate that PCBs in off-site sediments must be reduced to less than 1.8 ppm to protect from beef ingestion health risks. As a practical matter, sediment removal under all alternatives to be considered involves removal of essentially all stream sediments in affected portions of the streams.

Finally, it should be noted that the typical case beef ingestion model assumes long-term (9 years) human ingestion of beef containing the average off-site waterway sediment PCB concentration (23.4 ppm). Because the model also assumes a linear relationship between both sediment PCB content and exposure duration and upperbound cancer risk, the carcinogenic risks associated with ingesting beef for shorter time periods or beef exposed to sediments with lower average PCB concentrations are proportionately decreased. These risks for varying exposure durations and sediment concentrations are shown on Table A-3 in Appendix A. When applied specifically to the pasture property located just west of the Site (average sediment PCB concentration in the unnamed tributary of 2.0 ppm), an unacceptable cancer risk ($>10^{-5}$) would result only if beef raised in this pasture was eaten by the same person consistently for approximately eight years. However, cattle have been grazing on the land only since late 1988; therefore, consistent consumption of beef from cattle raised on the land may have occurred for, at the most, one year. Based on a one-year exposure period and the 2.0 ppm PCB concentration in sediments, Table A-3 shows that the current risk associated with this pastureland is 1.2×10^{-6}, well below the acceptable level of 10^{-5}.

b. Allowable Exposure Based on Potential ARARS

(1) PCBs: The PCB Spill Cleanup Policy does not establish numerical cleanup standards for PCBs spilled directly into streams. However, since the numerical cleanup standards for soils are considered potentially relevant and appropriate (See Appendix B), an exposure level of 10 ppm for sediments will be assumed to be the ARAR-based requirement.

(2) VOCs: No chemical-specific ARARs on VOCs in sediment have been found.

c. Response Action Objectives

- For human health effects due to off-site sediments, prevent ingestion by cattle of sediments containing PCBs at levels that result in unacceptable excess cancer risks ($>10^{-5}$) for a human consuming that beef in typical exposures.

- For compliance with chemical-specific ARARs, prevent exposure to sediments which have greater than 10 ppm PCBs in nonrestricted access areas.

4. BUILDINGS

The Site buildings of interest are the:

- Main Building
- South Warehouse
- Small Shed north of Main Building

These buildings are considered as a group without differentiation even though the shed was only used to house a tractor.

The compounds of interest in the buildings are PCBs.

a. Allowable Exposure Based on Human Health Risk

The EA found that the excess cancer risks for the no action scenario on-site trespasser are unacceptable ($>10^{-5}$) for indoor PCB vapor inhalation and for dermal contact with the floors containing PCBs. The potential for adverse noncarcinogenic effects on the on-site trespasser is unacceptable (MDD/RfD> 1.0) for indoor inhalation of PCB vapors and for dermal contact with floors containing PCBs. The same is true for the industrial development scenario in which the excess cancer risks are also unacceptable ($>10^{-5}$) for indoor vapor inhalation and for dermal contact with the floors and walls.

The buildings and floors are assumed to be removed for one industrial use scenario and for the residential development scenario.

The EA exposure models are used to calculate media concentrations which would yield acceptable excess cancer risks or acceptable risks for adverse noncarcinogenic effects for those scenarios with existing unacceptable building surface concentrations. The results are shown in Table II-3.

TABLE II-3

ACCEPTABLE BUILDING SURFACE PCB CONCENTRATIONS - HUMAN HEALTH BASIS

			PCB Concentrations (ug/100cm²) Typical Case	
Scenario	Risk	Pathway	Current	Acceptable Risk
No Action - Trespasser	Cancer	Dermal (Floors)	702	117
No Action - Trespasser	Noncancer	Dermal (Floors)	702	23
Industrial Development	Cancer	Dermal (Floors)	702	4.1
Industrial Development	Cancer	Dermal (Walls)	19.9	4.1
Industrial Development	Noncancer	Dermal (Floors)	702	29
Industrial Development	Noncancer	Dermal (Walls)	19.9	CCA*

*Current Concentration Acceptable.

NOTE: To protect the future on-site worker from indoor vapor inhalation, either the slab must be removed or a vapor barrier installed on the slab.

The data indicate that protection of the on-site trespasser from dermal contact requires that PCBs on the floors be reduced to less than 23 ug/100cm^2. To protect the future industrial worker from dermal contact, the PCBs on the walls and floors must be reduced to less than 4.1 ug/100cm^2. Based on the EA exposure models, the future on-site worker can be protected to an acceptable risk from indoor vapor inhalation within the existing buildings only by removal of the slab or by installation of a vapor barrier on the slab.

b. Allowable Exposure Based on Potential ARARs

Under the PCB Spill Cleanup Policy, solid surfaces with PCBs shall be cleaned up as follows:

- o In Restricted Access Areas:
  - High contact solid surfaces and low contact indoor impervious solid surfaces will be decontaminated to 10 ug/100cm^2.
  - Low contact, indoor, nonimpervious surfaces may be cleaned either to 10 ug/100cm^2 or to 100 ug/100cm^2 and encapsulated. The U.S. EPA Regional Administrator, however, retains the authority to disallow the encapsulation option.
  - Low contact, outdoor surfaces (both impervious and nonimpervious) shall be cleaned to 100 ug/100cm^2.
- o In Nonrestricted Access Areas:
  - Indoor solid surfaces and high contact outdoor solid surfaces (less than 6 feet high) shall be cleaned to 10 ug/100cm^2.
  - Indoor vault areas and low contact, outdoor, impervious solid surfaces shall be decontaminated to 10 ug/100cm^2.
  - Low contact, outdoor, nonimpervious solid surfaces may be cleaned to 10 ug/100 cm^2 or to 100 ug/100 cm^2 and encapsulated. The U.S. EPA Regional Administrator, however, retains the authority to disallow the encapsulation option.

c. Response Action Objectives

- o For human health effects, prevent inhalation of vapors and direct contact with the walls and floors that would result in unacceptable ($>10^{-5}$) excess cancer risk from PCBs and in unacceptable adverse noncarcinogenic effects (MDD/RfD>1.0) in typical exposures.

- o For compliance with chemical-specific ARARs, prevent exposure to building surfaces with more than 10 ug/100 cm^2 PCBs.

5. SURFACE WATERS

The surface water bodies that are of interest are the four on-site containment ponds, the East Pin Oak Creek and the unnamed tributary. In all cases, the compounds of interest are PCBs and VOCs.

a. Allowable Exposure Based on Human Health Risk

For on-site surface water, the EA found that the excess cancer risks for the no action scenario due to dermal contact via wading in the on-site ponds and off-site surface water are acceptable ($<10^{-5}$). Likewise, for adverse noncarcinogenic effects in the no action scenario, the potential for dermal contact via wading is acceptable (MDD/RfD<1.0). The industrial and residential development scenarios are not evaluated because the on-site ponds are assumed to be removed in those scenarios.

b. Allowable Exposure Based on Potential ARARs

The Safe Drinking Water Act (SDWA) regulations in 40 CFR 141 includes a proposed maximum concentration level for PCBs and various VOCs. However, the on-site surface water ponds, the unnamed tributary, and East Pin Oak Creek are neither actual nor feasible sources of drinking water; therefore, these potential ARARs are neither applicable nor relevant. The federal Clean Water Act water quality criteria have been incorporated in the Missouri Water Quality Standards in 10 CSR 20-7.031. These standards are applied by establishing stream classifications based on use of water in the specific stream and specifying chemical-specific concentration limits for the various stream classifications. However, since on- and off-site surface waters adjacent to the Site are not classified by Missouri Department of Natural Resources, the water quality standards are not applicable. In addition, since these waters are not used for drinking water or aquatic life and the livestock watering use standards address neither PCBs nor VOCs, these potential ARARs are neither applicable nor relevant.

It should be noted that even if the Missouri Water Quality Standards in 10 CSR 20-7.031 were ARARs, these would be met. East Pin Oak Creek is first classified at its confluence with West Pin Oak Creek, approximately 1.5 miles downstream from the Site. The designated uses are livestock and wild life watering and aquatic life. The standards for the uses do not regulate VOCs and limit PCBs to less than detection limit levels. The farthest downstream sampling of East Pin Oak Creek (approximately 2,000 feet downstream) showed no detectable PCBs, and sampling of the creek sediments for an additional 900 feet downstream of this point showed no detectable PCBs in the sediment.

c. Response Action Objectives

Current conditions of the surface waters are acceptable. However, if surface waters are involved in response activities, any water discharged will meet appropriate discharge limitations.

6. GROUNDWATER

Based on the RI findings, the groundwater of interest is the shallow groundwater in the overburden soil. The potential for groundwater contaminants to reach the bedrock groundwater is very low. The compounds of interest are PCBs and VOCs.

a. Allowable Exposure Based on Human Health Risk Assessment

Because of the nature of the overburden soils, their low hydraulic conductivity, and the low volume of groundwater available, the groundwater is not considered a feasible source of public drinking water. In addition, Missouri Regulations in 10 CSR 23-3.090 (Missouri Private Well Construction Standards - Rules and Organizational Structure for RSMo 256.600, Missouri Department of Natural Resources (DNR), September, 1987) require that private wells in this area have minimum total casing depths of 40 feet with a minimum of 15 feet of casing penetrating into bedrock. This regulation does not allow development of private wells in the shallow groundwater. Therefore, the drinking water pathway for human consumption is not present and the current groundwater situation does not pose a risk to human health. The only existing pathway (ingestion of beef from cattle which drink the groundwater after it discharges into the unnamed tributary) represents an acceptable risk.

b. Allowable Exposure Based on Potential ARARs

Potential chemical-specific ARARs for the shallow groundwater are state water quality standards in 10 CSR 20-7.031, which are applicable only to waters in aquifers and caves. The regulation defines an aquifer as a water-bearing stratum of sand, gravel, or bedrock. The shallow on-site groundwater is in soil. In addition the Missouri Department of Natural Resources guidance policy states that aquifers show minimum yields of 5 to 10 gpm or have significant impacts on stream recharge. The shallow groundwater also meets neither of these criteria. Therefore, the shallow groundwater is not an aquifer and the groundwater water quality standards are not applicable.

The only on-site or near-site use of the shallow groundwater, either as groundwater or creek recharge, is livestock watering. Since no standards for PCBs and VOCs exist for this use, no potential relevant and appropriate water quality requirements apply to the shallow groundwater.

c. Response Action Objectives

The current groundwater condition is acceptable.

7. SUMMARY

The results of the preceding analyses are summarized on Table II-4 which identifies media requiring action to meet response action objectives based on either human health risk or potential ARARs. Table II-4 also identifies the affected scenario for each medium and associated pathways for exposure levels controlled by health risk. For all cases PCBs are the only compounds of interest because no human health risks or ARARs associated with VOCs were identified.

TABLE II-4

SUMMARY OF MEDIA REQUIRING ACTION TO MEET RESPONSE ACTION OBJECTIVES

	Medium	Exposure Level* Controlled By	Affected Scenario	Pathway
1.	Off-Site Sediments	Health	All	Beef Ingestion
2.	Site Buildings (floors)	Health	No Action Industrial Dev.	Dermal Dermal
3.	Site Buildings (walls)	Health	Industrial Dev.	Dermal
4.	Site Buildings	Health	No Action Industrial Dev.	Inhalation
5.	Site Soils	Health	Residential Dev.	Inhalation
6.	Site Soils**	ARAR	No Action Industrial Dev.	NA

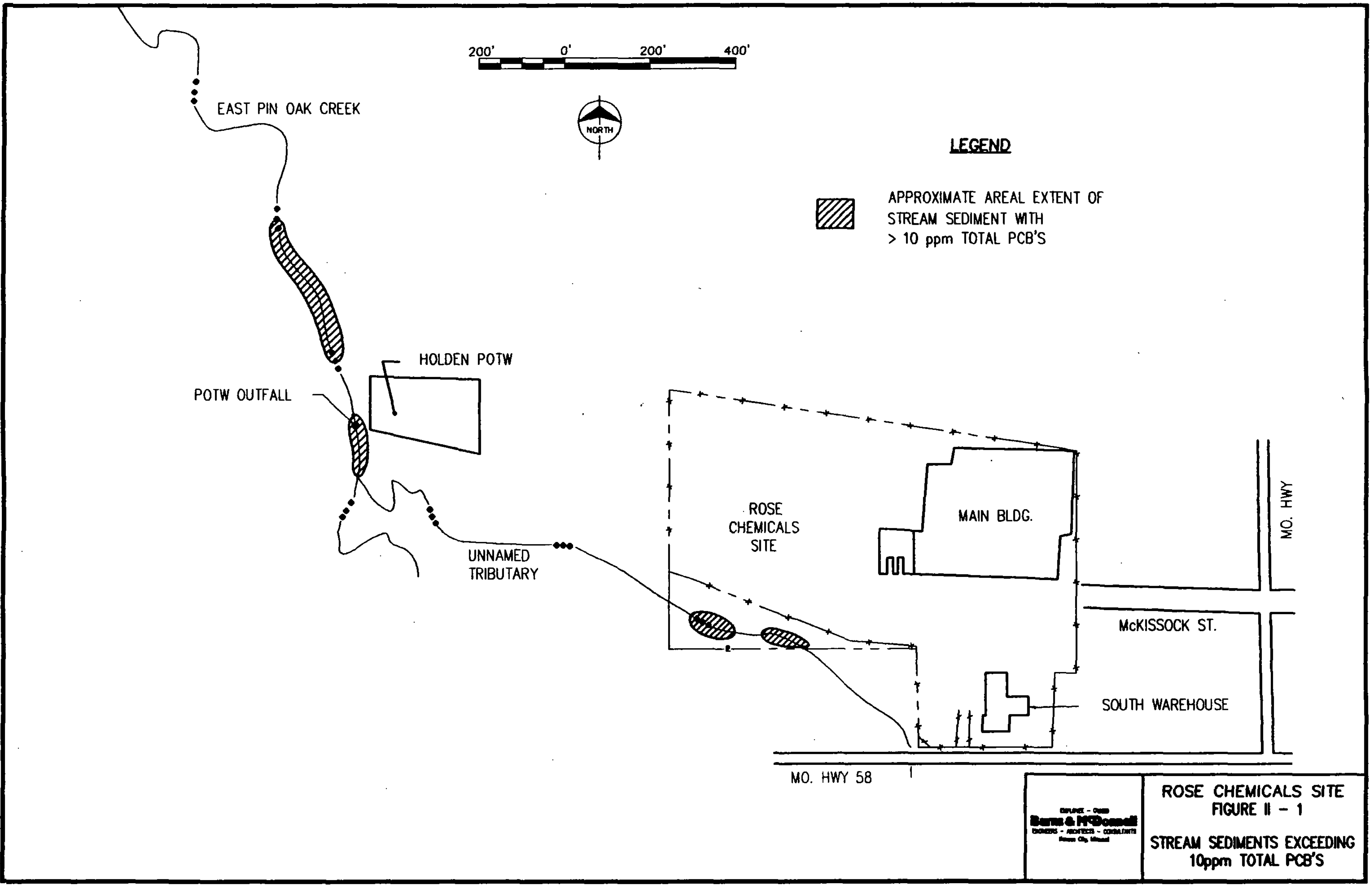
*Exposure levels may vary depending upon site-use scenario.
**Includes on-site sediments.

C. MEDIA VOLUMES AND AREAS

This section estimates volumes and areas of the different media which may be affected by the response action objectives.

For media containing PCBs, the volumes or areas are estimated using (1) information developed during the RI, (2) acceptable exposure concentrations from response action objectives, and (3) reasonable assumptions about Site geometry.

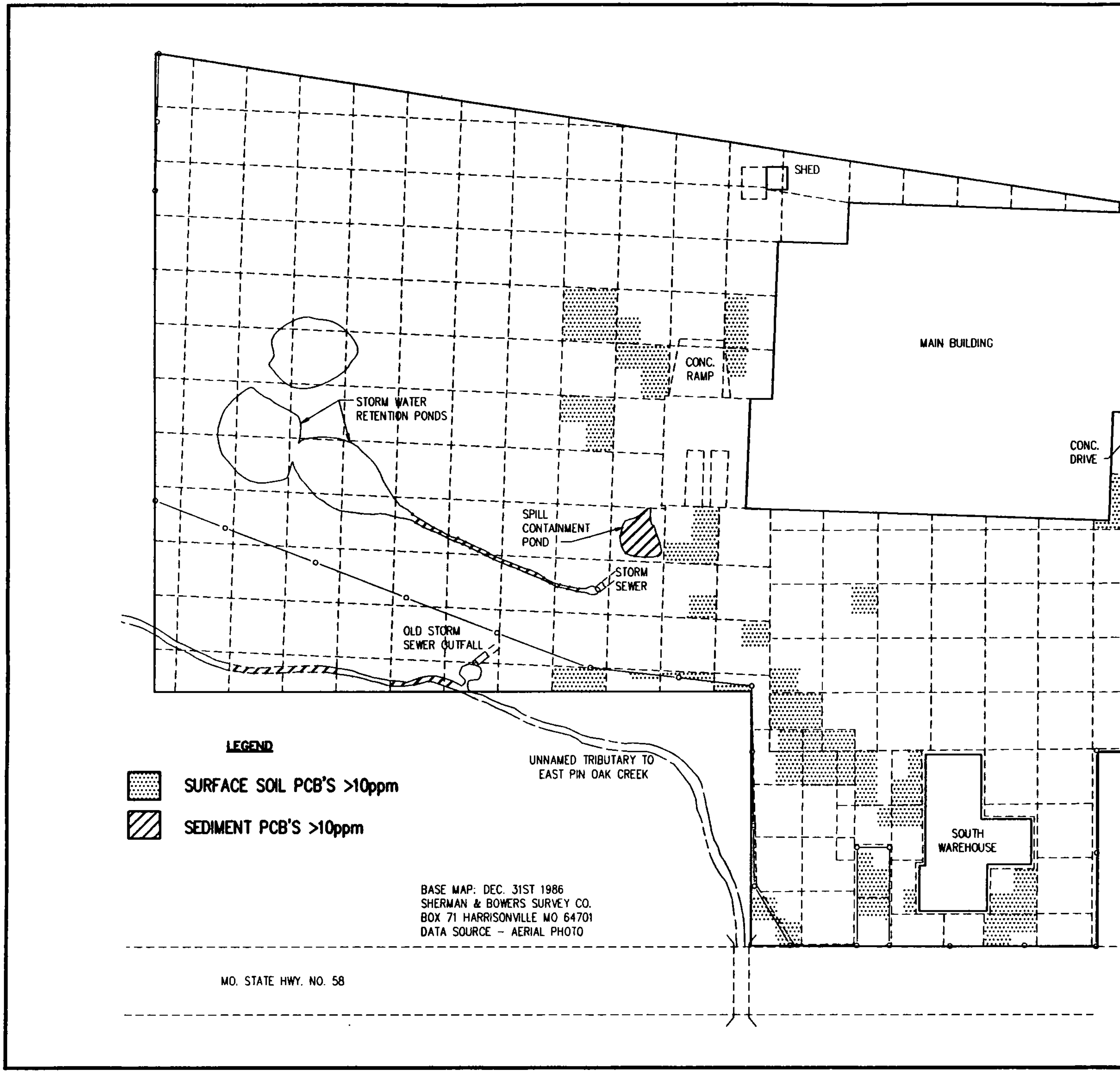
The locations of interest are presented on Figures II-1, II-2, and II-3. Estimated volumes and areas of various site media are presented in Tables II-5 and II-6, respectively. Assumptions used to prepare Tables II-5 and II-6 are discussed in Appendix C.



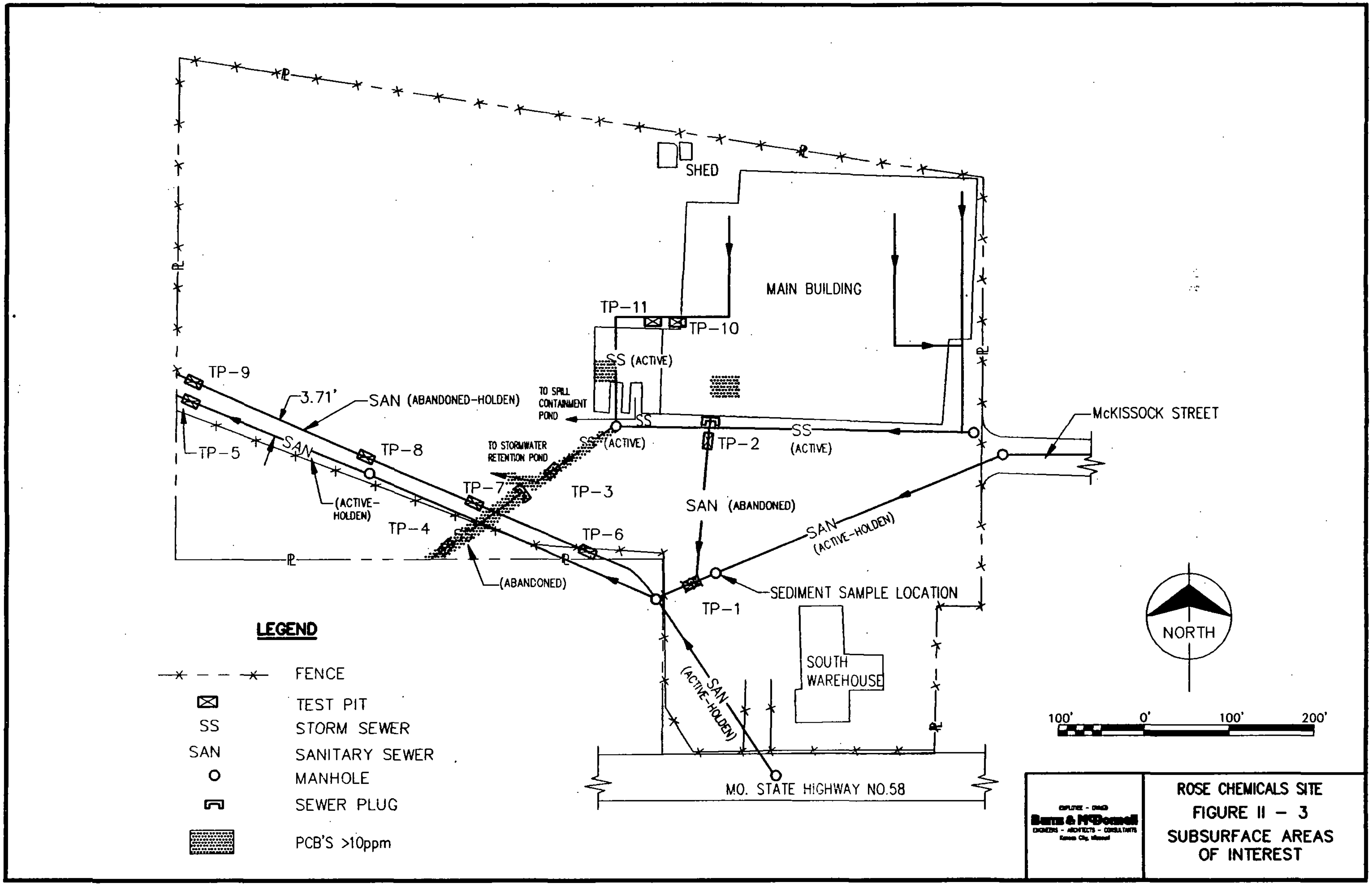
ROSE CHEMICALS SITE
FIGURE II – 1

STREAM SEDIMENTS EXCEEDING
10ppm TOTAL PCB'S

ROSE39 10-11-89 SR



ROSE CHEMICALS SITE
FIGURE II-2
ON-SITE SURFACE AREAS OF INTEREST



ROSE CHEMICALS SITE
FIGURE II – 3
SUBSURFACE AREAS OF INTEREST

ROSE46 10-10-89 S.R.

TABLE II-5

ESTIMATED CLEANUP VOLUMES OR WEIGHTS

Media and Location	PCB Cleanup Level (ppm)	Estimated Cleanup Volume (Yd^3)
Exterior Soils Adjacent to Sewers		
Site Storm and Sanitary Sewer	<10	342-482
Site Storm and Sanitary Sewer	<0.35	342-482
Soils		
Under Main Building	<10	370
Under Main Building	<0.35	61,040
Site	<10	2,600
Site	<0.35	13,465
Sediments		
Drainage Ditch	<10	34
Drainage Ditch	<0.35	34
Surface Water Retention Ponds	<10	0
Surface Water Retention Ponds	<0.35	2,640
Spill Containment Pond	<10	60
Spill Containment Pond	<0.35	60
Creeks	1.8	826
Buildings		
Main Building-Concrete Slab	Total Removal	2,024
Main Building-Uncompacted Insulation	Total Removal	10*
Main Building-Aboveground Structural Materials	Total Removal	510*
South Warehouse-Concrete Slab	Total Removal	211
South Warehouse-Uncompacted Insulation	Total Removal	2*
South Warehouse-Aboveground Structural Materials	Total Removal	37*
Surface Waters**		
Surface Water Retention Ponds	Permit Requirements	2,400
Spill Containment Pond	Permit Requirements	300

*Tons of building material.
**Volumes given assume ponds are full. This incidental water is treated prior to discharge.

TABLE II-6

ESTIMATED AREA - BUILDINGS

Medium	Total Area (Ft^2)
1. Main Building	
Floor Surfaces	93,700
Interior Walls	26,000
Interior Ceilings	93,700
Interior Beams & Fixtures	9,400
2. South Warehouse	
Floor Surfaces	9,750
Interior Walls	9,600
Interior Ceilings	9,750
Interior Beams & Fixtures	980

D. IDENTIFICATION OF GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS

1. GENERAL

EPA Guidance uses the following hierarchical classification scheme to describe the range of response actions available at a site:

- o General Response Action
- o Technology Type
- o Technology Process Option

A general response action is the broadest technological category defined by the EPA. Examples are: no action, institutional actions, removal, treatment, and containment. A technology type is a grouping of similar processes. Examples of technology types under the general response category of treatment are: thermal, chemical, physical, and biological treatment. A technology process option is even more specialized. Examples of technology process options under the category of thermal treatment are: incineration, vitrification, and low temperature thermal stripping.

Five general response actions for media at the Site are identified as follows:

- o No Action
- o Institutional Actions
- o Removal
- o Treatment
- o Containment

For each general response action, the technology types and respective process options are evaluated for each medium requiring response action.

2. SITE SOILS

Site soils include surface soils, exterior subsurface soils and interior subsurface soils. The potential technologies and process options were screened and the results of the initial screening are shown in Table II-7.

The screening for each process option is summarized in Table II-8. A discussion of the evaluation of technology types and process options is presented in Appendix D.

3. SEDIMENTS

Sediments are located in the on-site ponds, unnamed tributary, and East Pin Oak Creek. Generally, treatment technologies which are feasible for soils are also feasible for sediments (after the sediment has been excavated). In situ technologies are not appropriate for sediment in creek beds. Potential technologies for sediments are summarized in Table II-9 and discussed in Appendix D.

TABLE II-7

SCREENING RESULTS FOR POTENTIAL TECHNOLOGIES AND PROCESS OPTIONS - SITE SOILS

Response Action	Feasibility
NO ACTION	Feasible
INSTITUTIONAL ACTIONS	
Deed Restriction	Feasible
Fencing	Feasible
REMOVAL TECHNOLOGIES	
Conventional Excavation	Feasible
TREATMENT	
Thermal	
Incineration (Off-Site)	
Infrared Thermal Treatment (Shirco)	Not Feasible
Rotary Kiln Incineration	Feasible
Circulating Bed Combustion (CBC)	Not Feasible
Vitrification	
In Situ Vitrification	Not Feasible
Electric Pyrolyzer	Not Feasible
Low Temperature Thermal Stripping	
X-TRAX™	Not Feasible
Chemical	
Chemical Extraction	
B.E.S.T.	Not Feasible
CF Systems	Not Feasible
Soil Washing	Not Feasible
Chemical Extraction/Treatment	
Galson APEG System	Not Feasible
Chemical/Physical	
Stabilization/Solidification	
Hazcon	Not Feasible
Soil Mixing	
Detoxifier™	Not Feasible
Geo-Con Deep Soil Mixing	Not Feasible
Biological	
Detox Industries System	Not Feasible
Biotrol Soils Treatment System	Not Feasible
CONTAINMENT	
On-Site TSCA Landfill	Not Feasible
Off-Site TSCA Landfill	Feasible
Capping	Feasible

Table II-8
TECHNOLOGY SCREENING MATRIX - SITE SOILS

Soil General Response Actions	Remedial Technology	Process Options	Description	First Screening Comments	Effectiveness	Implementability	Cost	Second Screening
No Action	None	No action	No action	Applicable to large portion of the 13 acre Site as indicated by soil sampling.	Effective for some areas of the Site.	Not Applicable	Baseline minimum	Feasible for most of the Site
Institutional Actions	Access Restrictions	Deed Restriction	Limit future use of Site	City of Holden owns the property.	Effective in restricting future use.	Well demonstrated	Low	Feasible
		Fencing	Fencing of entire Site	Present situation	Effective in restricting access to Site.	Well demonstrated	Low	Feasible
Removal	Excavation	Heavy equipment Hand labor	Excavation is a prerequisite for most waste treatment technologies.	Excavation is feasible. Since most treatment and disposal technologies use excavation as part of the process, excavation will probably be performed to some extent at the Site.	With proper treatment or disposal, excavation can eliminate long term Site monitoring.	Well demonstrated technology. Numerous vendors are available. With adequate care, release of dust is minimized.	Moderate	Feasible
Treatment	Thermal	Vitrification Electric Pyrolyzer	Extremely high temperature process which destroys organics and produces a glassy stabilized mass.	Feasible for soils which contain toxic metals that require fixation in a vitrified mass.	Effective	Existing technology, however equipment availability uncertain. Permits and local approval probably required. Max. feed size 4 inch.	High	Not feasible: extra step of vitrifying the soil is unnecessary.
		In Situ Vitrification	Extremely high temperature process which destroys organics and produces a glassy stabilized mass.	Not feasible for treatment of contamination at shallow depths. Surface soil and shallow soil would require burial to treatment depth or be covered to a treatment depth.	Effectiveness has not been demonstrated for an actual site. with PCBs. Demonstrations have been limited in size. Treatment at perimeter of vitrified zone uncertain.	Implementablity of large scale operation has not been demonstrated.	Moderate	Not feasible: 1) possible residuals remain. 2) long term monitoring of vitrified mass may be required.
		Rotary Kiln (on-site or off-site)	Temperatures up to to 2200 F are used to incinerate organic chemicals such as PCBs and VOCs. Recent development of enhanced oxygen combustion burner appears to have improved economics.	Feasible	Effective	Minimum volume of material such as 1000 tons generally required for on-site incineration. Mechanical pretreatment of soil: feed size 1-2". Site soils are well below typical feed material limits of 10,000 to 15,000 ppm PCBs. Disposal of ash must be considered. Treatment/disposal of scrubber water required. Local approval of on-site unit is unlikely because located within city limit.	On-site: moderate to high Off-site: high	Off-site: Feasible On-site: Not feasible, local approval is unlikely.
		Circulating Bed Combustor (on-site)	High temperature incineration of organics. High mixing energies aid the combustion process and help to reduce fuel consumption and metals emissions. In-bed limestone addition for acid gas capture removes the requirement for wet scrubbers and scrubber-water treatment. Ogden has CBC with national operating permit.	Feasible	Effective	Feed size: 1". Fine particles at Site could result in high particulate loading of flue gases. Maximum feed material limits of 10,000 ppm PCBs. Disposal of ash must be considered. Local approval of on-site unit is unlikely because located within city limit.	Moderate to high	Off-site: unit not available. On-site: Not feasible: local approval is unlikely.

Table II-8
TECHNOLOGY SCREENING MATRIX - SITE SOILS

Soil General Response Actions	Remedial Technology	Process Options	Description	First Screening Comments	Effectiveness	Implementability	Cost	Second Screening
Treatment (continued)	Thermal (continued)	Infrared Themal Treatment (Shirco) (on-site)	A conveyor belt furnace using silicon carbide elements to heat soil to temperatures at 1200 F in primary chamber. Evolved gases are treated at 2200 F in a secondary combustion chamber A 100 ton per day unit with a US EPA national operating permit is available.	Feasible	Effective	Minimum volume possible requirement. Feed size 1"-2". Fine soil could fall through belt. Treatment/disposal of scrubber water. Disposal of ash must be considered. Site preparation for equipment. National operating standard to 15,000 ppm PCBs. Local approval of on-site unit is unlikely because located within city limit.	Moderate to high	Off-site: No unit available. On-site: Not feasible: local approval is unlikely.
		Low temperature thermal stripping (on-site) Chemical Waste Man. X*TRAX	Mobile unit which treats organics with boiling point less than 800F Testing on CERCLA site in Calif. Soil flows through pug mill or rotary drum equipped with heat transfer surfaces.	Not commercially demonstrated for full-scale operations for large volumes of PCB soils.	Not fully tested. Preliminary indications in literature is that process is not as effective as complete incineration.	Feed < 1.25 inches. High percent of clay and silt a problem.	Moderate to high	Not feasible: 1) unit not commercially availble. 2) not demonstrated for full scale operations. 3) residual PCBs probably remain in soils.
	Chemical Extraction	B.E.S.T	Aliphatic amine solvents are mixed with soil at low temperature. Solids are separated by centrifugation and sent to a dryer. Used at a Georgia site to treat 100 tons of sludge per day.	Feasibility unknown until bench scale testing of soil samples is performed. Minimum volume of soil at Site is probably required to mobilize unit. Not demonstrated for PCBs in soils on a full scale basis.	Not as effective as incineration. Treatment residuals remain. Numerous repeats of the treatment process are probably required to reach PCB levels of less than 10ppm.	Wastewater requires treatment. Extracted PCB concentrate requires disposal. Treated soil requires disposal. Analysis of soil required for disposal as non-hazardous material. Soil must be slurried for pumping purposes. Particle size restrictions for process. Ph of soil is raised to ≥10 for process. Variable feed may require reformulation of reagent mixtures.	Moderate	Not feasible : 1) Backfilling of treated soil on-site requires U.S.EPA approval. 2) Treatment of effluent. 3) Minimum volume required. 4) Treatment residuals remain. 5) Not demonstrated for full-scale operation with soils.
		CF Systems	Uses liquified gases as the extracting solvent to remove organics from soil. Generally propane is used for soils. A pilot scale system has been tested on PCB laden sediments for New Bedford Harbor Superfund site , MA during Sept. 1988. The PCU-200 mobile unit has a nominal capacity of 200 bbl slurried soil per day.	Pilot testing probably required to determine feasibility at the Site	Pilot testing at the New Bedford Harbor Superfund site indicates numerous passes though the unit are required to reach PCB levels less than 10ppm.	Maximum particle size is 5mm Soil must be slurried for pumping. Not appropriate for inorganics such as metals. Treated soil must be tested to determine disposal requirements. Extracted PCB concentrate requires disposal.	Moderate	Not feasible: 1) Backfilling of treated soil on-site requires U.S.EPA approval 2)Feed requirements restrictive. 3) Not fully demonstrated on a commercial scale. 4) Pilot testing required 5) Treatment residuals remain.

Table II-8
TECHNOLOGY SCREENING MATRIX - SITE SOILS

Soil General Response Actions	Remedial Technology	Process Options	Description	First Screening Comments	Effectiveness	Implementability	Cost	Second Screening
Treatment (continued)	Chemical Extraction (continued)	Conventional Soil Washing	Solvents dissolve and remove organic chemicals such as PCBs from the soil.	Soil washing of the clay rich Site soil would be very difficult compared to sandy soils. Chemical treatment of clays and mechanical separation of clays from the washing fluid is difficult. If soil is slurried with water, then large volumes of waste water are generated.	Pilot tests generally required. Treatment residuals are likely to remain. Some soil washing processes use chemicals that pose health and safety problems.	Coarse materials (wood, pebbles) are generaly removed by screening. Treatment bi-products require treatment /disposal. Fine particles(silts and clays) found at the Site are difficult to remove from the washing fluid. Variation in the soil composition may require frequent reformulation of the washing fluid. Some washing fluids may have adverse environmental impact. Testing of soil prior to disposal is required.	Moderate	Not feasible: 1) clays difficult to treat. 2) backfilling of treated soil on-site requires U.S.EPA approval. 3) feed requirements restrictive. 4) pilot testing required. 5) treatment residuals remain.
	Chemical Destruction glycolate dechlorination	Galson APEG System	Soil and reagent are mixed to produce a slurry and heated to 150 F. An alkoxide reacts with the chlorine atoms on the biphenyl ring to produce glycol-biphenyls and KCl. At the end of the process the soil is centrifuged and washed by several volumes of water. Reagent and wash waters are recycled.	Bench scale tests must be run to determine treatability requirements. A pilot scale test at the Site is probably necessary to determine feasibility. Feasible for Wide Beach, NY Superfund Site(PCBs) where a full scale process unit is being constructed. Early 1990 treatment should begin. Probably a large volume of PCB contaminated soil would be required at the Site before a full scale unit could be considered for construction.	Pilot studies at Wide Beach were successful, however effectiveness of full scale operation has not been demonstrated. Treatment residuals remain. If the soil is to be backfilled at the Site, these residuals could be a future liability.	Generates wastewater that must be treated. Aluminum and other metals that react under highly alkaline conditions may react to produce hydrogen gas and increase reagent volume. Soil testing will indicate if this is a problem. Reagent and wash waters are separated by centrifugation. Probably clay rich soils are more difficult to separate from reagents. Availability of full scale unit: requires construction. Testing of treated soil required prior to disposal as non-hazardous.	Moderate	Not feasible: 1) Unit must be built for Site. 2) Not fully tested on a commercial scale. 3) clay rich soils difficult. 4) Backfilling of treated soil on-site requires U.S.EPA approval. 5) Feed requirements restrictive. 6) Pilot testing required 7) Treatment residuals are likely to remain.
	Chemical treatment/ soil mixing	"Detoxifier" Toxic Treatments Inc.	A variety of chemicals can be injected through the mixer shaft to treat soil. Solidification/ stabilization is feasible by injection of pozzolanic materials. Different types of chemicals and biologic agents are available for soil mixing for in situ treatment include: biologic catalysts, chemical reagents, hot air or steam. Can configure to various site geometries and topographies. If successful can eliminate long term liability.	A developing technology that is not demonstrated for sites with PCBs however, process is similar to the Geo-Con system that has been tested at sites with PCBs in soils.	Not demonstrated at this time however, suspect the treatment will result in residual levels of PCBs in the treated soil. Residual PCBs could be a concern in the future.	Availability of unit unknown. Sandy loam preferred to clay. Fines require more mixing. If PCB residuals remain, long term monitoring is a possible requirement.	Moderate	Not feasible: 1) Only one unit is built and is currently being tested. 2) Not fully tested for sites with PCBs primary compound of interest. 3) Treatment residuals remain on-site--long term monitoring is a possible requirement. 4) Clay rich soils could prove difficult to treat.
		Geo-Con Deep Soil Mixing	Similar to Detoxifier. International Waste Technology has used its own reagent with the Geo-Con technology on PCB wastes. Technology was demonstrated at a site in Hialeah, Florida.	Results of demonstration : TCLP leachates of treated soil indicate no detectable PCBs. (detection limit: 1.0 μg/L) Special leach tests ANS 16.1 and MCC-1P results were same. ANS(American Nuclear Society) MCC(Materials CharacterizationCenter)	Appears effective for immobilizing PCBs. However PCBs remain on-site in a stabilized mass. The site soils at Hialeah are fairly sandy unlike the clay rich soil at the Site. It is not known if clays are effectively treated.	Minimum volume of material may be required to mobilize the special unit. Implementation appears to be easier than above ground mixing procedure used by Hazcon process. Volume increase of treated soil less than Hazcon process.	Moderate	Not feasible: 1) not demonstrated for clay rich soils. 2) Long term monitoring of treated soil is a potential requirement.

Table II-8
TECHNOLOGY SCREENING MATRIX - SITE SOILS

Soil General Response Actions	Remedial Technology	Process Options	Description	First Screening Comments	Effectiveness	Implementability	Cost	Second Screening
	Stabilization/ Solidification	Hazcon Process	Soil is blended with cementing agents. Chemical additives react with PCBs.	TCLP leaching results were inconclusive because untreated soil leachate had non-detectible PCB levels.	Suitable for PCBs. Process uses ALMEG(aluminum hydroxide methyl ethyl glycol) for dehalogenation of PCBs. Has been used for CERCLA wastes.	Fine particle size< 200 mesh can delay setting and curing. Small particles also coat larger particles, weakening bonds between particles and cement. Particle size > 1/4 inch is not suitable Appears to be a "messy" operation especially if in situ mixing is used.	Moderate	Not feasible: 1) Volume of soil is doubled. 2) Disposal of solidified blocks of soil on-site must be approved by the U.S. EPA. 3) Clay rich soils at the Site pose potential problems.
Containment	On-site Landfill	TSCA Landfill	Construction of a TSCA landfill. Double bottom liner with leachate collection system is installed. Surface of landfill is capped with liner and an extra layer of soil is installed. Site is revegetated and run-off and run-on controls are implemented. A monitoring well program is established.	Approval of such a facility may be denied if other reasonable alternatives exist. Groundwater monitoring program is required for at least 30 years.	Does not reduce volume or toxicity of waste. Does not remove long term liability to the generator. Requires considerable handling of Site soils, but provides same long - term effectiveness as capping.	Well demonstrated technology	Moderate	Not feasible: 1) Long term monitoring, maintenance, and liability. 2) Provides same long-term effectiveness as capping, but at higher cost.
	Cap	Multi-media cap	Construction of a surface cap to prevent infiltration of water and erosion of Site. Because excavation is not required, minimum disturbance of the Site results.	Actual soil areas that are contaminated do not appear to extend over a large areal extent. Contamination is generally found near the buildings, thus is localized and can be capped. Contamination which is located along sewer lines forms a narrow, linear pattern that is probably impractical to cap.	Site characteristics of clayey soils will inhibit migration of the PCBs. PCBs are highly sorbed to the soil, thus are difficult to mobilize TCLP of PCB soils in general indicate the difficultly of mobilizing PCBs by water. Does not remove the long term liability to the generator.	Technology is well demonstrated. Long term monitoring of the Site will probably be required. Long term maintenance of the cap may be necessary. Design life is a potential unknown.	Low to moderate	Feasible
	Off-site TSCA landfill	Chemical Waste Man.: Emelle, Alabama UA USPCI : Lone Mountain Site, Oklahoma (permit pending) U.S. Ecology: Beatty, Nevada	Generally constructed with a double bottom liner with leachate collection system is installed. Surface of landfill is capped with liner and an extra layer of soil is installed. Site is revegetated and run-off and run-on controls are implemented. A monitoring well program is established.	Well demonstrated technology that can be implemented in a time span shorter than on-site treatment technologies.	Does not reduce volume or toxicity of waste. Risk of release of material during transit.	Technology is well documented. Low levels of VOCs at the Site should pose no problem based on expected TCLP results.	Moderate	Feasible
Biologcal	Biodegradation of PCBs	Detox Industries	Digestion of PCBs by naturally adapted microorganisms. Soil is slurried in a open-top tank with nutrients and air supply. Reaction time is slow--2 to 4 months for PCBs.	Not demonstrated at an actual PCB cleanup site.	Not demonstrated. It is speculated that residual levels of PCBs could remain in the treated soil. Future liability may not be eliminated if the treated soil is backfilled at the Site.	The reaction time for PCBs of 2 to 4 months is impractical for a large scale operation.	Moderate	Not feasible: 1) Not yet demonstrated as effective for an actual PCB site. 2) Reaction time is slow. 3) Residual levels of PCBs.
		Biotrol Soils Treatment System	Similar to soil washing, however effluent is treated by an on-site biological fixed-film reactor.	Not demonstrated at an actual PCB cleanup site.	Soil washing system may leave residual PCBs in treated soil. Future liability may not be eliminated if the treated soil is backfilled at the Site.	No full scale demonstration of the technology is reported.	Moderate	Not feasible: 1) Not yet demonstrated as effective for an actual PCB site. 2) Residual levels of PCBs.

TABLE II-9

SCREENING RESULTS FOR POTENTIAL TECHNOLOGIES AND PROCESS OPTIONS - SEDIMENTS

Response Action	Feasibility
NO ACTION	Feasible
INSTITUTIONAL ACTIONS	
Deed Restriction	Feasible
Fencing	Feasible
REMOVAL TECHNOLOGIES	
Conventional Excavation	Feasible
Dredging	Feasible
High Pressure Washing	Feasible
TREATMENT	
Thermal	
Incineration (Off-Site)	
Infrared Thermal Treatment (Shirco)	Not Feasible
Rotary Kiln Incineration	Feasible
Circulating Bed Combustion (CBC)	Not Feasible
Vitrification	
In Situ Vitrification	Not Feasible
Electric Pyrolyzer	Not Feasible
Low Temperature Thermal Stripping	
X-TRAX™	Not Feasible
Chemical	
Chemical Extraction	
B.E.S.T.	Not Feasible
CF Systems	Not Feasible
Soil Washing	Not Feasible
Chemical Extraction/Treatment	
Calson APEG System	Not Feasible
Solidification/Treatment	
Hazcon	Not Feasible
Chemical/Mixing	
Detoxifier™	Not Feasible
Geo-Con Deep Soil Mixing	Not Feasible
Biological	
Detox Industries System	Not Feasible
Biotrol Soils Treatment System	Not Feasible
Physical	
Dewatering	Feasible
CONTAINMENT	
On-Site TSCA Landfill	Not Feasible
Off-Site TSCA Landfill	Feasible
Capping (On-Site)	Feasible

4. BUILDINGS AND STRUCTURES

Information on response technologies for buildings and structures has been obtained from Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites, U.S. EPA, March 1985. More recent technological developments are gathered from U.S. EPA SITE reports and from vendor supplied information. A summary of the potential building and structure technologies is presented in Table II-10, and the screening criteria for each process option is summarized in Table II-11. A discussion of the technologies for buildings and structures is presented in Appendix D.

5. SURFACE WATERS

Surface waters are located in the on-site ponds, the unnamed tributary, and East Pin Oak Creek. The current condition of these waters is acceptable. However, surface waters involved in response activities (e.g., surface water removal to allow access to underlying sediments) may require treatment in order to meet appropriate discharge limitations. Potential technologies for surface waters are summarized in Table II-12. A discussion of potential technologies for surface waters is presented in Appendix D.

TABLE II-10

SCREENING RESULTS FOR POTENTIAL TECHNOLOGIES AND PROCESS OPTIONS - BUILDINGS AND STRUCTURES

Response Action	Feasibility
NO ACTION	Not Feasible
INSTITUTIONAL ACTIONS	
Fencing	Feasible
Deed Restriction	Feasible
REMOVAL TECHNOLOGIES	
Demolition	Feasible
Dismantling	Feasible
Excavation	Feasible
TREATMENT	
Thermal	
Incineration (Off-Site)	
Infrared Thermal Treatment (Shirco)	Not Feasible
Rotary Kiln Incineration	Feasible
Circulating Bed Combustion (CBC)	Not Feasible
Vitrification	
In Situ Vitrification	Not Feasible
Electric Pyrolyzer	Not Feasible
Low Temperature Thermal Stripping	
X-TRAX™	Not Feasible
Chemical	
Chemical Extraction	
Envirosolv	Feasible
RadKleen	Not Feasible
Solvent Cleaning	Feasible
Photochemical Degradation	Feasible
Physical	
Dusting/Vacuuming	Feasible
Scarification	Feasible
Grit Blasting	Feasible
Hydroblasting	Feasible
Steam Cleaning	Feasible
Encapsulation	
Painting/Coating	Feasible
K-20 Sealant or Similar Material	Feasible
Epoxy Cement	Feasible
CONTAINMENT	
On-Site TSCA Landfill	Not Feasible
Off-Site TSCA Landfill	Feasible
Capping of Slab	Feasible

Table II-11
TECHNOLOGY SCREENING MATRIX - BUILDINGS AND STRUCTURES

Structure General Response	Remedial Technology	Process Options	Description	First Screening Comments (general implementability)	Effectiveness	Implementability	Cost	Second Screening
No Action	No Action	No Action	No Action	Not Feasible: Main Building and South Warehouse are identified as source of risk to human health.	Not effective because PCBs remain.	Not applicable	Baseline minimum	Not feasible: 1) based on PCB Spill Cleanup Policy. 2) based on Endangerment Assessment.
Institutional Actions	Access Restrictions	Deed Restriction	Limit future use of Site.	City of Holden owns the property.	Effective in restricting future use.	Well demonstrated	Low	Feasible
		Fencing/sealing	Fencing of property and fencing/sealing of structures.	Property presently fenced. Fencing/sealing of building an additional option.	Does not further reduce volume or toxicity of contaminants. Structural integrity of building decreases with time.	Well documented technology. Monitoring of Site required.	Low	Feasible
Removal Technologies	Physical	Demolition	Complete removal of structure.	Technically feasible.	Achieves maximum decontamination by removing all building materials, structures, and equipment from the Site.	Well demonstrated technology. Eliminates long term monitoring. Generates large volumes of contaminated debris. May expose nearby residents to dust.	Moderate	Feasible
		Dismantling	Selective removal of portions of structure.	Technically feasible.	Effective if all contaminated debris is removed. Effective for areas that are difficult to treat--concrete floors,walls, insulation, and wood.	Exact boundaries of contaminated media not always known. Generates large volumes of contaminated debris. May expose nearby residents to dust.	Moderate	Feasible
		Excavation	Excavation is a prerequisite for most treatment technologies.	Excavation is feasible. Since most treatment and disposal technologies use excavation as part of the process, excavation will probably be performed to some extent at the Site.	With proper treatment or disposal excavation can eliminate long term Site monitoring.	Well demonstrated technology. Numerous vendors are available. May cause release of dust to the environment.	Moderate	Feasible
Treatment	Thermal	Vitrification Electric Pyrolyzer	Extremely high temperature process which destroys organics and produces a glassy stabilized mass. Applicable for concrete, wood, and other non-metalic building materials.	Feasible for non-metalic building materials containing toxic metals that require fixation in a vitrified mass.	Effective	Existing technology, however equipment availability uncertain. Compliance with standards and local approval probably required. Maximum feed size is about 4 inches.	High	Not feasible: Not necessary to melt to a glass because there is no metals contamination at the Site.
		In Situ Vitrification	Extremely high temperature process which destroys organics and produces a glassy stabilized mass. Applicable for concrete, wood, and other non-metalic building materials.	Not designed for concrete slabs. Concrete would require shredding to a granular material and burial to treatment depth.	Not effective for non-buried slab. If implemented, effective treatment of PCBs at the perimeter of vitrified zone is uncertain.	Not suitable for shallow contaminants. Evolved gases must be collected.	High	Not feasible: 1) implementability 2) uncertain effectiveness at perimeter of vitrified zone.

Table II-11
TECHNOLOGY SCREENING MATRIX - BUILDINGS AND STRUCTURES

Structure General Response	Remedial Technology	Process Options	Description	First Screening Comments (general implementability)	Effectiveness	Implementability	Cost	Second Screening
Treatment continued	Chemical	"Envirosolv" EGI or similar solvents	A penetrating solvent which is allowed to penetrate surface for several hours. Vendor claims the solvent "draws" PCBs to the surface. Water is used to remove the dried solvent. Water is collected for activated charcoal treatment.	Vendor claims Envirosolv is less hazardous than conventional solvents. Envirosolv is non-flammable and biodegradable. Apparently Envirosolv poses less health risks than other types of solvents.	Vendor implies that the solvent penetrates several inches. There is some question on how treatment depth is verified considering surface wipes are used to verify cleanup level.	Appears to generate a large volume of waste water.	Moderate	Feasible but some concerns: 1) PCBs which have penetrated concrete may pose future problem. 2) Post cleanup sampling may add significant cost. 3) Dispersal of PCBs or solvents.
		"RadKleen"	Uses FREON(stable, nonpolar, noncombustible), which permits rapid wetting of surfaces and easy particulate separation.	The technology is designed for the removal of radionuclides from contaminated surfaces, however the U.S.EPA has identified the process as potentially suitable for PCBs.	No documentation for actual PCB treatment	Requires secondary treatment of used FREON.	Moderate	Not feasible: 1) not tested for PCBs. 2) Post cleanup sampling may add significant cost.
		Photochemical degradation	Exposure of chemicals to UV light.	Feasible for surfaces only Artificail light sources may result in UV exposure hazards.	Effective for surfaces only. Not effective where UV light does not penetrate.	Easily implementable by exposing surfaces to sunlight. Artificial lighting is necessary in a building interior.	Low to moderate High electrical consumption, unless sunlight is used.	Artificial UV: not feasible 1)Energy requirements. 2) Surface only. Sunlight: Feasible for exposed surfaces.
Containment	On-site Landfill	TSCA Landfill:	Construction of a TSCA landfill. Double bottom liner with leachate collection system is installed. Surface of landfill is capped with liner and an extra layer of soil is installed. Site is revegetated and run-off and run-on controls are implaced. A monitoring well program is established.	Approval of such a facility may be denied if other reasonable alternatives exist. Groundwater monitoring program is required for at least 30 years.	Does not reduce volume or toxicity of waste. Does not remove long term liability to the generator. Requires handling of Site PCB material, but long-term effectiveness is same as capping.	Well demonstrated technology.	Moderate	Not feasible 1) Long term monitoring, maintenance, and liability. 2) Provides same long-term effectiveness as capping but at higher cost.
	Cap	Multi-media cap	Construction of a surface cap to prevent infiltration of water and erosion of Site. Because excavation is not required minimum disturbance of the Site results.	Option to leave slab in place after demolition of above ground structure.	Volume of PCB materials is not reduced at Site, however prevents short term exposure to PCBs that would be associated demolition of slab.	Technology is well demonstrated. Long term monitoring of the Site will probably be required. Long term maintenance of the cap may be necessary. Design life is a potential unknown.	Low to moderate	Feasible
	Off-site TSCA landfill	Chemical Waste Man.: Emelle, Alabama USPCI : Lone Mountain Site, Oklahoma (permit pending) U.S. Ecology: Beatty, Nevada	TSCA landfill: Generally constructed with a double bottom liner with leachate collection system is installed. Surface of landfill is capped with liner and an extra layer of soil is installed. Site is revegetated and run-off and run-on controls are implaced. A monitoring well program is established.	Well demonstrated technology that can be implemented in a time span shorter than on-site treatment technologies.	Does not reduce volume or toxicity of waste. Risk of release of material during transit.	Technology is well documented. PCB levels in building materials maybe limimed to 1000 ppm PCBs if landfilled after November 8 1990.	Moderate	Feasible

Table II-11
TECHNOLOGY SCREENING MATRIX - BUILDINGS AND STRUCTURES

Structure General Response	Remedial Technology	Process Options	Description	First Screening Comments (general implementability)	Effectiveness	Implementability	Cost	Second Screening
Treatment continued	Physical continued	Steam Cleaning	Surface cleaning with portable steam generators. Can be used to remove adhered dust and dirt which contains PCBs.	Feasible for surfaces: Sheet metal skin and metal supports. Possibly feasible for preatreatment of porous surfaces prior to more intensive treatment.	Ineffective for areas where PCBs have penetrated the surface. Not as effective as hydroblasting which has benefit of solvent or surfactant addition.	Generates large volumes of contaminated liquids that require disposal.	Moderate	Feasible
		Scarification	Removal of concrete to a controlled depth by specialized equipment	Depth of PCB penetration in concrete must be known to determine depth of scarification.	Very effective if all contaminated concrete is removed.	Generates large volumes of debris which requires disposal.	High	Feasible
	Encapsulation	Painting/coating	Surface coating over contamination.	Feasible	Does not reduce volume or toxicity. of contaminants. Not considered effective if any uncertainties exist. If future use can not be restricted, a basic assumption is that the barrier will be penetrated by future re-modeling etc. Long term monitoring and maintenance is required. Thin barrier not durable.	Does not generate waste material. Requires monitoring during life of structure.	Moderate	Feasible: 1) Treats surfaces only. 2) Long term monitoring. 3) Control of future use. 4) Cleaning of surface may be required for paint adherence.
		K-20 Sealant or similar products	Sealant that penetrates concrete to form a protective barrier.	Feasible	Does not reduce volume or toxicity. of contaminants. Not considered effective if any uncertainties exist. If future use can not be restricted, a basic assumption is that the barrier will be penetrated by future re-modeling etc. Long term monitoring and maintenance is required.	Generally requires pretreatment of the surface. –solvent cleaning, scarification.	Moderate	Feasible: 1) Long term monitoring. 2) Control of future use. 3) Pretreatment of surface may be required.
		Epoxy coating	Coating of epoxy that forms a durable surface. Some coatings include a colored layer which appears after surface wear reaches a certain depth.	Feasible	Does not reduce volume or toxicity. of contaminants. Not considered effective if any uncertainties exist. If future use can not be restricted, a basic assumption is that the barrier will be penetrated by future re-modeling etc. Long term monitoring and maintenance is required.	Surface probably requires mechanical pretreatment to ensure bond with the epoxy.	Moderate	Feasible: 1) Long term monitoring. 2) Control of future use. 3) Pretreatment to ensure bond.
	Chemical	Solvent washing (general)	Treatment of surfaces with PCB solvents.	Could mobilize PCBs. PCB-laden solvents may enter cracks and contaminate soil. Solvents could carry PCBs further into concrete.	Probably effective for the first 0.5 inch. May increase PCB concentration at deeper levels in concrete.	Some solvents are flammable or pose certain health risks. Compounds with are chlorinated solvents could contaminate Site.	Moderate	Feasible but some concerns: 1) PCBs which have penetrated concrete may pose future problem. 2) Post cleanup sampling may add significant cost. 3) Dispersal of PCBs or solvents.

Table II-11
TECHNOLOGY SCREENING MATRIX - BUILDINGS AND STRUCTURES

Structure General Response	Remedial Technology	Process Options	Description	First Screening Comments (general implementability)	Effectiveness	Implementability	Cost	Second Screening
Treatment continued	Thermal continued	Rotary Kiln (on-site or off-site)	Temperatures of up to 2200 F are used to incinerate organic chemicals such as PCBs	Technically feasibile for concrete. Not feasible for steel building components.	Effective	On-site: Minimum volume of material such as 1000 ton generally required. Mechanical pretreatment of materials: feed size 1-2". Some concrete may exceed national operating standard if on-site unit is used. Disposal of ash must be considered. Local approval of on-site incineration is unlikely. Treatment/disposal of scrubber water required.	Off-site: high On-site: moderate to high	On-site: not feasible 1) local approval unlikely. 2) disposal of ash and treat-ment of scrubber water must be considered. 3) some concrete may exceed national operating standard of the incinerator. Off-site: feasible
		Circulating Bed Combustor (on-site)	High temperature incineration of organics. High mixing energies aid the combustion process and help to reduce fuel consumption and metals emissions. In-bed lime-stone addition for acid gas capture removes the requirement for wet scrubbers and scrubber-water treatment.	Technically feasibile for concrete. Not feasible for steel building components.	Effective	Feed size: max 1" Some concrete may exceed national operating standard if on-site unit is used. Typically 10,000 ppm PCBs limit. Disposal of ash must be considered. Local approval of on-site incineration is unlikely.	On-site: moderate to high	On-site: not feasible 1) local approval unlikely. 2) disposal of ash must be considered. 3) some concrete may exceed national operating standard of the incinerator. Off-site: CBC not available
		Infrared Themal Treatment (Shirco) (on-site)	A conveyor belt furnace using silicon carbide elements to heat waste to temperatures of 1200 F in primary chamber. Evolved gases are treated at 2200 F in a secondary combustion chamber. A 100 ton per day unit with a US EPA national operating permit is available.	Technically feasibile for concrete. Not feasible for steel building components.	Effective	Minimum volume: possibly required Feed size 1"-2". Treatment/disposal of scrubber water. Disposal of ash must be considered. Site preparation for equipment. Local approval of on-site incineration is unlikely. National operating standard allows burning for up to 15,000 ppm PCBs.	Moderate to high	On-site: not feasible 1) local approval unlikely. 2) disposal of ash must be considered. 3) some concrete may exceed national operating standard of the incinerator. Off-site: Unit not available
		Low temperature thermal stripping (on-site) Chemical Waste Man. X*TRAX	Mobile unit which treats organics with boiling point < 800F. Testing on CERCLA site in Calif. Soil flows through pug mill or rotary drum equippped with heat transfer surfaces.	Technically feasibile for concrete. Not feasible for steel building components.	Not fully tested. PCBs are probably not completely removed from concrete. No test information of concrete is reported.	Feed < 1.25 inches	Moderate to high	Not feasible: 1) unit being tested. 2) disposal of ash must be considered. 3) Residual PCBs probably remain in treated concrete.
	Physical	Dusting/ Vaccuuming	Removal of surface particulate material.	Feasible for lighty contaminated surfaces.	Treats lighty contaminated surfaces. Effective as a pretreatment prior to more intensive treatment.	Post cleaning sampling requirements. May have to be repeated until source of contamination is controlled. May spread some dust.	Low	Feasible in conjuction with other technologies.
		Gritblasting	Surface decontamination using high velocity stream of abrasives	Feasible for surfaces only.	Ineffective for areas where PCBs have penetrated the surface.	Generates large volumes of dust and debris that require disposal.	Moderate	Feasible for cleaning of concrete walls with surface PCB coating.
		Hydroblasting/ waterwashing	Use of hot or cold water combined wth abrasives, solvents, surfactants at various pressures.	Feasible for surfaces only.	Ineffective for areas where PCBs have penetrated the surface.	Generates large volumes of contaminated liquids that require disposal.	Moderate	Feasible for metal surfaces.

TABLE II-12

POTENTIAL TECHNOLOGIES - SURFACE WATERS

NO ACTION	Feasible
INSTITUTIONAL ACTIONS	
Deed Restriction	Feasible
Fencing	Feasible
REMOVAL TECHNOLOGIES	
Pumping	Feasible
TREATMENT	
Physical/Chemical	
Activated Carbon	Feasible
DISCHARGE	
On-Site Discharge	
Discharge to Stream	Feasible
Land Application	Feasible
Off-Site Discharge	
Discharge to POTW	Feasible
CONTAINMENT	
On-Site Ponds	Not Feasible

* * * * *

PART III

DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. DEVELOPMENT OF ALTERNATIVES

In Part II, response action objectives were defined and feasible technologies were identified for the various Site media requiring response actions. In Part III, selected feasible technologies are used to develop eight overall response alternatives for the Site. The alternatives are designated numerically and range from Alternative 1, a no action alternative (as recommended by EPA Guidance and directed by the Final Work Plan), to Alternative 8, which allows unrestricted future Site use. Alternatives 2 through 7 provide a range of alternatives between the extremes of Alternatives 1 and 8.

Table III-1 presents the selected technologies of each alternative and how they address the media requiring response action. The development rationale for each alternative is explained in Appendix E. The alternatives are described and screened in the following section.

B. SCREENING OF ALTERNATIVES

1. INTRODUCTION

This section describes and screens the developed alternatives based upon their potential effectiveness, implementability, and cost. Those alternatives which remain will be analyzed in detail in Part IV.

TABLE III-1
ALTERNATIVE DEVELOPMENT MATRIX
ROSE CHEMICALS SITE

MEDIUM	TECHNOLOGY TYPE	RESPONSE ALTERNATIVES									
		1	2	3	4A	4B	5	6A	6B	7	8
not applicable	Fencing	X	X	X	X	X	X	X	X		
	Deed Restrictions	X	X	X	X	X	X	X	X	X	
SEDIMENTS (2)	Remove off-site sediments		X	X	X	X	X	X	X	X	X
	Cap (1) on-site sediments >10 ppm PCBs			X	X		X	X			
	Remove on-site sediments >10 ppm PCBs					X			X	X	
	Remove on-site sediments >0.35 ppm PCBs										X
SURFACE WATER	Treat surface water from dewatered stream sediments		X	X	X	X	X	X	X	X	X
	Treat surface water from ponds			X	X	X	X	X	X	X	X
SOILS (2)	Cap (1) site soils >10 ppm PCBs			X	X		X	X			
	Remove site soils >10 ppm PCBs					X			X	X	
	Remove site soils >0.35 ppm PCBs										X
BUILDINGS	Decontaminate buildings				X	X		X	X		
	Demolish and remove buildings						X			X	X
CONCRETE SLABS	Decontaminate concrete slabs				X	X					
	Cap (1) concrete slabs						X				
	Demolish and remove concrete slabs							X	X	X	X

NOTES:
1. Cap consists of a multi-layer RCRA type cap.
2. In alternatives which utilize capping, select soils and sediments which cannot be practically capped are removed.

Effectiveness of an alternative is evaluated based on its ability to protect human health and the environment and to reduce toxicity, mobility and volume of PCBs. The protection is provided by using the screened technologies to satisfy the medium specific response objectives set forth in Part II. The degree of effectiveness (protection) provided by an alternative varies depending upon the technologies selected. Both short-term (during remedy implementation) and long-term (after remediation is complete) components of effectiveness are evaluated. Reduction of toxicity, mobility, and volume refers to the use of treatment to decrease the inherent risks associated with PCBs. All alternatives which remove materials off-site are developed with two options for handling the removed material. One option is to incinerate the materials and the other is landfilling. In all cases incineration is considered a more effective technology in terms of reduction through treatment; however, incineration is not practical for much of the material remaining at the Site. Both landfill and incineration options will be carried to detailed analysis in Part IV.

Implementability of an alternative at the Site is a measure of its technical and administrative feasibility during both the construction phase and the operation and maintenance phase. Technical feasibility refers to the ability to construct, operate and maintain the alternative. Administrative feasibility refers to the ability to obtain approvals and the availability of facilities necessary to implement an alternative.

A detailed analysis of costs is not conducted during this screening. Capital and operation and maintenance (O&M) costs, however, are described qualitatively relative to the extreme alternatives (Alternative 1 and Alternative 8).

2. ALTERNATIVE 1: NO ACTION

a. Description

The Final Work Plan for the Site requires that a no action alternative be included in the alternatives. This alternative allows no Site use within the foreseeable future (30 years) and access is prohibited.

This alternative uses the selected feasible technologies listed in Table III-2 to address the media requiring action.

TABLE III-2

ALTERNATIVE 1 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off-Site Sediments	None
2. On-Site Sediments	Site Fencing
3. Site Buildings	Site Fencing
4. Site Soils	Site Fencing

This alternative consists of fencing the Site and deed restrictions on future use.

b. <u>Effectiveness</u>

This alternative does not effectively accomplish the media specific objectives presented in Part II, because the risks to the off-site resident and on-site trespasser are still unacceptable. The short-term risks associated with this alternative are insignificant.

c. <u>Implementability</u>

This alternative is technically feasible, but it may not be acceptable to the local, state, or federal governments.

d. <u>Cost</u>

The capital and O&M costs are low.

3. <u>ALTERNATIVE 2: REMOVE OFF-SITE PCB SEDIMENTS ONLY</u>

a. <u>Description</u>

This alternative removes only off-site stream sediments containing PCBs from East Pin Oak Creek and its unnamed tributary and fences the Site. This alternative allows no Site use or access for the foreseeable future (30 years).

This alternative uses the selected feasible technologies listed in Table III-3 to address the media requiring action.

TABLE III-3

ALTERNATIVE 2 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off-Site Sediments	Removal
2. On-Site Sediments	Site Fencing
3. Site Buildings	Site Fencing
4. Site Soils	Site Fencing

The alternative incorporates excavation and disposal technologies for stream sediments; it also treats on-site any associated surface water collected during the sediment excavation. During sediment removal, release of PCBs into surface waters is expected. This release is minimized, and any affected surface water is treated and discharged. Fencing and deed restrictions are still necessary.

b. Effectiveness

The potential for temporary increased health risks to off-site residents due to alternative implementation is limited because of this alternative's narrow scope.

This alternative satisfies the response objective for off-site stream sediments by removing them from East Pin Oak Creek and its unnamed tributary. However, unacceptable risks to human health remain for the on-site trespasser scenario developed in the EA. The long-term effectiveness of this alternative is unacceptable.

c. Implementability

This alternative is technically feasible since it utilizes proven technologies. The Site requires long-term monitoring. This alternative may not be administratively feasible due to its lack of effectiveness. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but regulatory standards must be met.

d. Cost

The capital and O&M costs are relatively low because of the low level of the remedial technology employed. Transportation and disposal costs for removed sediment at a TSCA landfill are volume dependent.

4. ALTERNATIVE 3: REMOVE OFF- AND ON-SITE PCB SEDIMENTS: CAP SITE

a. Description

This alternative combines a Site cap with the technologies of Alternative 2. The alternative allows no Site use or access for the foreseeable future (30 years).

This alternative uses the selected feasible technologies listed in Table III-3 to address the media requiring action.

TABLE III-4

ALTERNATIVE 3 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Building Fence
3. Site Soils	Capping

In addition to removal of off- and on-site sediments containing PCBs, this alternative uses capping technology for areas where PCBs are found in soils at concentrations above 10 ppm PCBs. Areas of soils containing PCBs where capping is not practical are removed. The spill containment and storm water retention ponds are drained and backfilled with clean soil. The drained water is treated on-site and discharged. Fences are placed around the Site and around the Site buildings to prevent entry by a potential on-site trespasser. Fencing and deed restrictions are still necessary.

b. Effectiveness

In the short-term, a potential for temporary increased health risks to on-site workers and the off-site residents during the project implementation exists. Proper construction procedures can abate dust generation or off-site tracking of PCBs and can provide adequate short-term effectiveness.

With maintained access controls (fences), this alternative may provide the long-term effectiveness necessary to satisfy the response objectives of Part II. The buildings are fenced so that the risk to the on-site trespasser is reduced.

c. Implementability

This alternative is technically feasible. The Site requires long-term monitoring and maintenance. A desire by local community or regulatory agencies to allow some future Site use could make this alternative administratively infeasible. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but regulatory standards must be met.

d. <u>Cost</u>

The capital and operating and maintenance costs are moderate. Transportation and disposal costs for removed sediment and soil at a TSCA landfill are volume dependent.

5. ALTERNATIVES 4-7: COMMON COMPONENTS

Alternatives 4-7 consist of several common activities and discharge. Each alternative removes and disposes of off- and on-site sediments containing PCBs. The alternatives also collect and treat on-site surface water resulting from the stream sediment removal or drainage of on-site containment ponds. Site soils containing PCBs are dealt with in one of two ways - capping (Option A) or removal (Option B). In Option A, Site soils containing PCBs which cannot practically be capped are removed.

Each alternative also implements institutional options which restrict the future use of the Site.

6. ALTERNATIVE 4 (OPTIONS A AND B): REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE OR CAP SITE SOILS; CLEAN BUILDINGS AND CONCRETE

a. <u>Description</u>

This alternative combines the common alternative components described above with surficial cleaning of the buildings including the concrete slabs. The Site and buildings are limited to light industrial uses by deed restrictions.

This alternative uses the selected feasible technologies listed in Table III-5 to address the media requiring action.

TABLE III-5

ALTERNATIVE 4 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Cleaning
3. Site Soils	Capping(A) or Removal(B)

The building skin, structures, and concrete slabs are treated using cleaning technologies. Concentrations of PCBs on the building surfaces are reduced to less than 10 $ug/100cm^2$. After the concrete is cleaned, it is encapsulated to provide a barrier to any PCBs remaining. The Site buildings are available for possible use.

Alternative 4 also consists of two response options for the Site soils. Option A installs a multi-media cap over Site soils containing greater than 10 ppm PCBs. Removal is necessary in those areas where capping is not practical (e.g., next to buildings, next to adjoining property). Option B excavates and disposes of Site soils containing greater than 10 ppm PCBs and then backfills the excavated areas with clean soil.

b. Effectiveness

In the short-term, the potential for temporary increased health risks due to implementation of Option A is the same as described for Alternative 3. The short-term risks are greater for Option B than Option A because of the increased excavation activity. Proper construction procedures can abate dust generation and off-site tracking of PCBs and can provide adequate short-term effectiveness.

This alternative provides the necessary effectiveness to satisfy the response objectives of Part II for industrial development. Option B is more effective because more material containing PCBs is removed from the Site. The long-term effectiveness of encapsulation methods used to remediate the concrete slabs is uncertain. The long-term liability associated with the buildings remaining on-site is also uncertain.

c. Implementability

This alternative is technically feasible. The Site requires long-term monitoring and maintenance. There is uncertainty whether encapsulating the slabs is administratively feasible. Regulatory agencies may not approve encapsulating the concrete slabs at the Site. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but regulatory standards must be met.

d. Cost

The capital and O&M costs are moderate to high. Option B costs are somewhat higher than Option A costs because of the transportation and final disposal costs associated with Option B. There is some uncertainty in the cost because of the iterative nature of the building and concrete cleaning and the soil and sediment removal.

Transportation and disposal cost for removed sediment and soil at a TSCA landfill are volume dependent.

7. ALTERNATIVE 5: REMOVE OFF- AND ON-SITE PCB SEDIMENTS; CAP SITE SOILS AND CONCRETE; REMOVE BUILDINGS

a. Description

This alternative is similar to Alternative 4 except that instead of attempting to clean the buildings the buildings are removed. The Site is limited to light industrial use by deed restrictions.

This alternative uses the selected feasible technologies listed in Table III-6 to address the media of interest.

TABLE III-6

ALTERNATIVE 5 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	
a. Building skin and structures	Removal
b. Concrete slabs	Capping
3. Site Soils	Capping

This alternative removes the buildings using conventional demolition and dust abatement techniques. The exposed concrete slabs are left in place. A multi-media cap is used to cover the Site to prevent exposure to soils containing greater than 10 ppm PCBs. The cap area is expanded to include the remaining concrete slabs.

b. Effectiveness

In the short-term the potential for temporary increased health risks to on-site workers and the local population is the same as Alternative 3 except that there is an incremental increase in risk associated with the building demolition. Proper construction and demolition procedures can abate dust generation and off-site tracking of PCBs and can provide adequate short-term effectiveness.

This alternative provides the necessary effectiveness to satisfy the response objectives of Part II for industrial development. The long-term effectiveness of the cap over the concrete slabs is of concern.

c. Implementability

This alternative is technically feasible. The Site requires long-term maintenance and monitoring. Regulatory agencies may not approve encapsulation of the concrete slabs at the Site. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but the regulatory standards must be met.

d. Cost

The capital and O&M costs are moderate to high. Transportation and disposal costs for removed sediment, soil, and building materials at a TSCA landfill are volume dependent.

8. <u>ALTERNATIVE 6 (OPTIONS A AND B): REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE OR CAP SITE SOILS; CLEAN BUILDINGS AND REMOVE CONCRETE</u>

a. <u>Description</u>

This alternative is much like Alternative 4 except that it cleans the buildings and removes the concrete slabs. The Site and buildings are limited to light industrial use by deed restrictions.

This alternative uses the selected feasible technologies listed in Table III-7 to address the media requiring action.

TABLE III-7

ALTERNATIVE 6 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off- and On-Site Sediment	Removal
2. Site Buildings	
a. building skin and structures	Cleaning
b. concrete slabs	Removal
3. Site Soils	Capping(A) or Removal(B)

The same cleaning technologies used in Alternative 4 are used to clean the buildings for this alternative. The portions of the concrete slabs remaining around the structural footings are cleaned and encapsulated. If other portions of the slabs are characterized as "clean," they will remain as well.

Alternative 6 also consists of the same two response options for Site soils containing PCBs as Alternative 4. Option A installs a multi-media cap over Site soils containing greater than 10 ppm PCBs. Removal is necessary in those areas where capping is not practical (e.g., next to buildings, next to adjoining property). Option B excavates and disposes of soils having greater than 10 ppm PCBs and then backfills the excavated areas with clean soil.

b. <u>Effectiveness</u>

The potential for temporary increased health risks to on-site workers and the local population is the same as Alternative 4 except that there is an incremental increase in risk associated with the concrete slab demolition. Proper construction and demolition procedures can abate dust generation and off-site tracking of PCBs and can provide adequate short-term effectiveness.

This alternative provides the necessary effectiveness to satisfy the response objectives of Part II for industrial development. The long-term effectiveness of encapsulating the soils and the remaining concrete slabs is still unknown.

c. <u>Implementability</u>

This alternative is technically feasible. This alternative requires long-term monitoring and maintenance. There is uncertainty whether encapsulation is administratively feasible. Regulatory agencies may not approve encapsulation of the remaining concrete slabs at the Site. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but regulatory standards must be met.

d. Cost

The capital and O&M costs are moderate to high. There is some uncertainty in the cost because of the iterative nature of the building cleaning, and soil and sediment excavation.

Transportation and disposal cost for removed sediment, soil, and building materials at a TSCA landfill are volume dependent.

9. ALTERNATIVE 7: REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE SITE SOILS BUILDINGS AND CONCRETE

a. Description

This alternative is much like Alternative 4 except that it removes both the buildings and the concrete slabs. The Site is limited to light industrial use by deed restrictions.

This alternative uses the selected feasible technologies listed in Table III-8 to address the media requiring action.

TABLE III-8

ALTERNATIVE 7 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Removal
3. Site Soils	Removal

This alternative uses conventional demolition and dust abatement technologies to remove the Site buildings and concrete. Conventional excavation technologies are used to remove all Site soils containing greater than 10 ppm PCBs. The excavated areas are backfilled with clean soil.

b. Effectiveness

The potential for temporary increased health risks to on-site workers and the local population is the same as Alternative 4 except that there is an incremental increase in risk associated with the building and concrete slab demolition. Proper demolition procedures can abate dust generation and off-site tracking of PCBs and can provide adequate short-term effectiveness.

This alternative provides the necessary effectiveness to satisfy the response objectives of Part II for industrial devlopment.

c. Implementability

This alternative is technically feasible. This alternative requires less long-term maintenance and monitoring than any previous alternative because the majority of the materials containing PCBs have been removed from the Site. There are no anticipated acceptance problems with regulatory agencies. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not require a permit, but regulatory standards must be met.

d. Cost

The capital and operating and maintenance costs are moderate to high. Transportation and disposal costs for removed sediment, soil, and building materials at a TSCA landfill are volume dependent.

10. ALTERNATIVE 8: COMPLETE REMOVAL OF OFF- AND ON-SITE PCB SEDIMENTS, SOILS, BUILDINGS, CONCRETE AND SEWERS

a. Description

Future use (including residential) of the Site in this alternative is not restricted.

This alternative uses the selected feasible technologies listed in Table III-9 to address the media requiring action.

TABLE III-9

ALTERNATIVE 8 - PROPOSED TECHNOLOGIES

Medium	Proposed Technologies
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Removal
3. Site Soils	Removal

This alternative removes the buildings and structures using the same methods as Alternative 7. The Site soils are also removed using the same methods as Alternative 7; however, the extent of the removal is different. This alternative removes Site soils which contain greater than 0.35 ppm PCBs. The excavated areas are backfilled with clean soil.

b. Effectiveness

The potential for temporary increased health risks to on-site workers and the local population during the project implementation is greatest for this alternative because the construction time is the greatest of any alternative.

Media containing PCBs are removed and disposed of so that cleanup levels at or below the acceptable levels for on-site residents (see Part II) are achieved.

c. Implementability

This alternative is technically feasible. Formal POTW approval is required for discharge of treated water to the POTW. Discharge of the treated water on-site does not reuire a permit, but regulatory standards must be met.

d. Cost

The capital costs are high. There is some uncertainty in the cost because of the iterative nature of the sediment and soil removal.

Transportation and disposal cost for removed sediment, soil, and building materials at a TSCA landfill are volume dependent.

C. SUMMARY OF SCREENING

This section described and screened eight response action alternatives on the basis of effectiveness and implementability. Alternative 2 is rejected because of lack of effectiveness. Alternative 1 also fails due to lack of effectiveness; however, the alternative will be analyzed in detail as recommended by EPA Guidance. The remainder of the alternatives are analyzed in detail in Part IV.

* * * *

PART IV

DETAILED ANALYSIS OF ALTERNATIVES

A. INTRODUCTION

This Part presents a detailed analysis of response alternatives and recommends a response alternative for the Site. Following EPA Guidance, the analysis consists of three parts as follows:

- More detailed descriptions of the seven alternatives found feasible after preliminary screening in Part III

- An assessment of each alternative based on U.S. EPA's nine evaluation criteria

- A comparative analysis of the alternatives to assess their relative performance with regard to U.S. EPA's evaluation criteria

The detailed description of each alternative includes some or all of the following: chosen process options, preliminary site layouts, general sequence of activities, further refined volumes or areas of interest, and discussions of limitations and assumptions. The construction sequences described and the process options identified in the descriptions are presented to provide the general approach and to allow costs of the alternatives to be estimated. Modifications of construction sequences and process options may occur during the design phase as more detailed information is developed. Table IV-1 summarizes the descriptions of the alternatives.

TABLE IV-1
SUMMARY OF ALTERNATIVE DESCRIPTIONS
ROSE CHEMICALS SITE

MEDIUM	TECHNOLOGY TYPE	RESPONSE ALTERNATIVES								
		1	3	4A	4B	5	6A	6B	7	8
not applicable	Fencing	X	X	X	X	X	X	X		
	Deed Restrictions	X	X	X	X	X	X	X	X	
SEDIMENTS (2)	Remove off-site sediments		X	X	X	X	X	X	X	X
	Cap (1) on-site sediments >10 ppm PCBs		X	X		X	X			
	Remove on-site sediments >10 ppm PCBs				X			X	X	
	Remove on-site sediments >0.35 ppm PCBs									X
SURFACE WATER	Treat surface water from dewatered stream sediments		X	X	X	X	X	X	X	X
	Treat surface water from ponds		X	X	X	X	X	X	X	X
SOILS (2)	Cap (1) site soils >10 ppm PCBs		X	X		X	X			
	Remove site soils >10 ppm PCBs				X			X	X	
	Remove site soils >0.35 ppm PCBs									X
BUILDINGS	Decontaminate buildings			X	X		X	X		
	Demolish and remove buildings					X			X	X
CONCRETE SLABS	Decontaminate concrete slabs			X	X					
	Cap (1) concrete slabs					X				
	Demolish and remove concrete slabs						X	X	X	X

NOTES:
1. Cap consists of a multi-layer RCRA type cap.
2. In alternatives which utilize capping, select soils and sediments which cannot be practically capped are removed.

After the description, each alternative is assessed against nine evaluation criteria as follows:

- o Overall protection of human health and the environment - The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

- o Compliance with ARARs - The assessment against this criterion describes how the alternative complies with ARARs, or if a waiver is required and how it is justified. The assessment also addresses other information from advisories, criteria, and guidance that the regulatory agencies and the PRPs have agreed is "to be considered."

- o Long-term effectiveness and permanence - The assessment of alternatives against this criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after response objectives have been met.

- o Reduction of toxicity, mobility, or volume through treatment - The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.

- Short-term effectiveness - The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met.

- Implementability - This assessment evaluates the technical and adminstrative feasibility of alternatives and the availability of required goods and services.

- Cost - This assessment evaluates the capital and operation and maintenance (O&M) costs of each alternative.

- State Acceptance - This assessment reflects the state's apparent preferences among or concerns about alternatives.

- Community Acceptance - This assessment reflects the community's apparent preferences among or concerns about alternatives.

The first two criteria (overall protection of human health and environment and compliance with ARARs) are categorized as threshold criteria that each alternative must meet. Potential chemical-, action-, and location-specific ARARs are listed in Appendix B. The following five criteria are categorized as primary criteria and represent the basis of analysis for the other concerns - institutional, technical, risk and cost.

The two final criteria, state acceptance and community acceptance, will be assessed following public and regulatory comment on the FS. Then why use Public acceptance as the sole rational for screening out thermal treatment?

The cost criterion includes both capital costs and the annual O&M costs. The present worth of annual O&M costs is calculated using a 5 percent discount rate over a 30-year term. The capital and present worth O&M costs are added together to obtain a total present worth cost for comparative purposes. The total present worth costs for the alternatives are believed to be within the accuracy (+50 percent to -30 percent) recommended by EPA Guidance. The costs are given in September 1989 dollars. The supporting data for these costs are presented in Appendix F.

Finally, a comparative analysis of the alternatives is performed to identify the relative performance of each alternative in relation to each specific evaluation criterion. The advantages and disadvantages of each alternative, are identified and compared. The selected alternative must meet the criteria for overall protection of human health and the environment and compliance with ARARs. The remaining five criteria listed above are used to identify major tradeoffs between alternatives.

B. ALTERNATIVE 1: NO ACTION

1. DESCRIPTION

The Final Work Plan requires that a no-action alternative be considered during the alternative analysis. It provides a baseline from which to compare all other alternatives. This alternative leaves the Site in its present state and employs only institutional controls. The fence surrounding the Site is expanded to enclose the portion of the unnamed tributary to East Pin Oak Creek which runs through the Site. Signs are placed to warn would-be trespassers of the Site dangers. A deed restriction is placed on the Site which prohibits use of the Site for the foreseeable future.

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative provides only limited control of exposure to PCBs. Therefore, the alternative provides only minimal reduction in the risk to human health associated with the Site as described previously in the RI.

b. Compliance With ARARs

The alternative does not result in satisfying any of the potential ARARs because no action is being taken at the Site.

c. Long-term Effectiveness and Permanence

No long-term controls (other than the institutional controls) of exposure are implemented. Therefore, there is no long-term effectiveness associated with this alternative. The residual risks as characterized by the EA are significant.

d. <u>Reduction Through Treatment</u>

This alternative implements no treatment; therefore, there is no reduction of toxicity, mobility, or volume of any media containing PCBs on the Site.

e. <u>Short-term Effectiveness</u>

Implementation of this alternative will result in a low potential for unacceptable short-term risks to human health.

f. <u>Implementability</u>

There are no implementability concerns associated with this alternative.

g. <u>Cost</u>

The capital costs and the annual O&M costs of Alternative 1 are estimated to be $23,000 and $3,200, respectively. The total present worth of these costs is $72,000.

C. <u>ALTERNATIVE 3: REMOVE OFF- AND ON-SITE STREAM PCB SEDIMENTS; CAP SITE</u>

In this alternative, the Site would not be available for use in the foreseeable future; it would be considered a no access area. The media requiring action to meet the response objectives are:

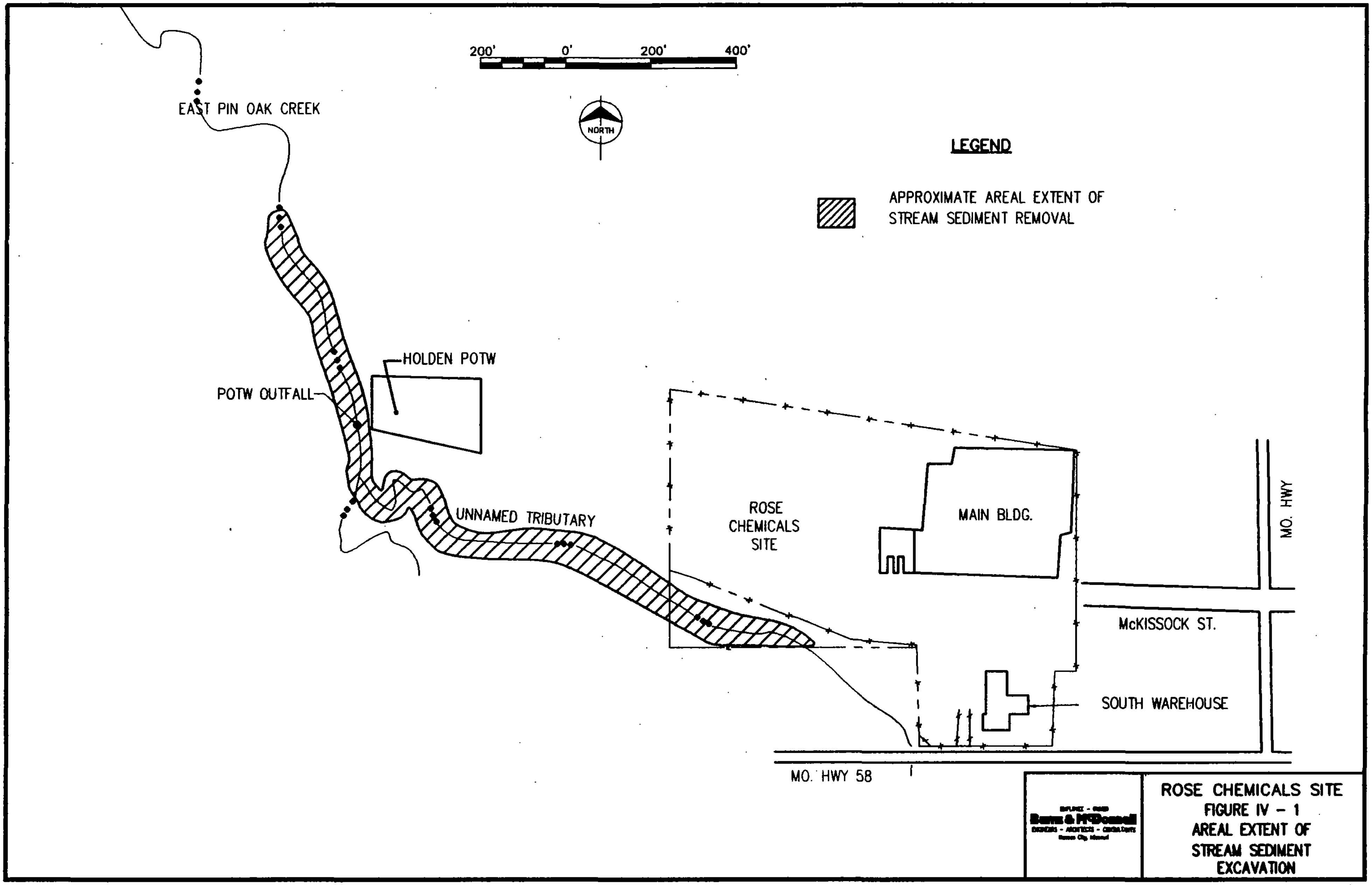
- o Sediments (health-based objective)
- o Site buildings (health-based objective)
- o Site soils (ARAR-based objective)

1. DESCRIPTION

This alternative: (1) removes and disposes of sediments containing PCBs from East Pin Oak Creek and its unnamed tributary, (2) installs a multi-media cap over Site areas which contain greater than 10 ppm PCBs, (3) removes soils which contain greater than 10ppm PCBs from Site areas which cannot be practically capped (adjacent to Site buildings and property lines), and (4) fences the Site buildings.

The areal extent of stream sediments which require removal is shown on Figure IV-1. Sediment is removed down to the bedrock or one foot, whichever is less. One foot of sediment is conservatively assumed to exist at all locations for costing purposes. Temporary roads are prepared with conventional construction equipment to provide access to some areas of East Pin Oak Creek and its unnamed tributary.

The discharge from the Holden POTW is routed around the sediment excavation area during remediation. A temporary dike also is positioned at the point farthest downstream in East Pin Oak Creek where PCBs were detected in a sediment sample. The dike serves to contain sediments which are disturbed and flow downstream during removal activities. Prior to sediment removal, the surface water remaining in East Pin Oak Creek is collected and pumped to a point downstream of the temporary dike. The pumping is stopped before the removal of this surface water significantly disturbs underlying sediments. Residual water remaining in the creeks during sediment removal will be collected and treated on-site by a carbon adsorption system.



ROSE CHEMICALS SITE
FIGURE IV – 1
AREAL EXTENT OF STREAM SEDIMENT EXCAVATION

ROSE41 9-25-89 S.R.

Removal of the stream sediments is accomplished using conventional excavation techniques (e.g., a backhoe or vacuum truck). Where stream access is not feasible, high pressure washing techniques may be used.

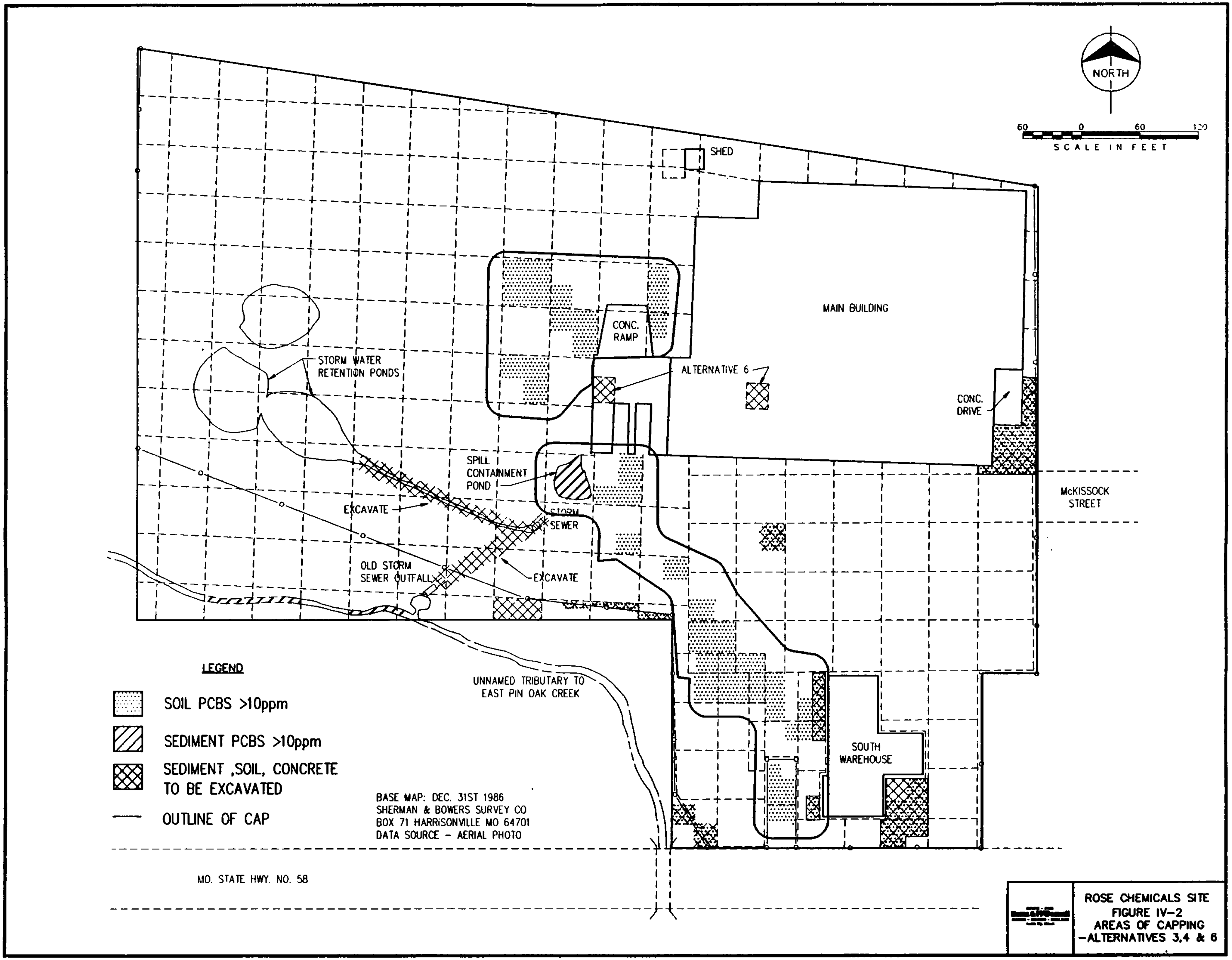
Removal begins at the point farthest upstream on the unnamed tributary where PCBs were detected in a sediment sample. It is assumed that 853 tons of sediment is excavated from the unnamed tributary and transported to the Site and prepared for transport to an off-site landfill or incinerator. Because the unnamed tributary is normally dry, the sediments excavated from this reach are assumed to require no dewatering.

The excavated sediments from East Pin Oak Creek are assumed to require some combination of settling, dewatering or stabilization. Supernatant water is decanted and treated on-site by a carbon adsorption system. The treated water is either discharged to the unnamed tributary on-site, land-applied on-site, or discharged to the Holden POTW. It is assumed that 470 tons of settled stream sediment remain for disposal and 70,300 gallons of supernatant and residual water are generated for treatment in the carbon adsorption system. Also, in order to transport the sediment, fly ash (or pozzolanic material) is assumed to be added to the sediment to dry it. It is assumed that 634 tons of sediment/fly ash material from East Pin Oak Creek are generated for transport to final disposal.

Site soils are assumed to be removed from areas which cannot be practically capped as shown in Figure IV-2. Soil samples taken from these areas during the RI contained greater than 10 ppm PCBs. The soil is removed using conventional construction equipment. The soil may be disposed of off-site or under the Site cap. For costing purposes, it is estimated that 1,912 tons of soil are excavated and disposed of off-site. Techniques to abate dust generation and migration are used during this activity.

After removal of the soils, and after the collection and removal of on-site surface waters from the on-site spill and stormwater retention ponds, a multi-media cap is placed over the areas shown in Figure IV-2. Samples taken from these areas during the RI contained greater than 10 ppm PCBs. The cap consists of (from bottom to top) 2 feet of compacted clay, a 40-mil synthetic liner, 1 foot of sand, a layer of filter fabic, and 2 feet of revegetated topsoil. The cap is graded to decrease soil erosion and infiltration. The on-site surface water is treated by a carbon adsorption system and either discharged to the unnamed tributary on-site, land-applied on-site, or discharged to the Holden POTW.

For costing purposes, it is assumed that the Site cap covers an area of 70,960 square feet and that 545,000 gallons (the 4 ponds are assumed full) of on-site surface water are collected and treated by the carbon adsorption system.



ROSE CHEMICALS SITE
FIGURE IV-2
AREAS OF CAPPING
-ALTERNATIVES 3,4 & 6

A contained decontamination pad is used to wash vehicles and equipment to avoid tracking PCBs off-site or away from East Pin Oak Creek and its unnamed tributary. The water used for decontamination is handled in the same manner as on-site surface water. For costing purposes a multiplier has been used to account for decontamination of personnel and equipment. The dewatered sediment, excavated soil, and spent activated carbon may be disposed of either by off-site landfilling or by off-site incineration.

The Site buildings are fenced with a six-foot high chain link fence with a single apron of barbed wire.

The institutional actions described in Alternative 1 are also implemented for this alternative.

2. <u>CRITERIA ASSESSMENT</u>

a. <u>Overall Protection</u>

This alternative protects human health and the environment by removing off-site sediments which contain PCBs. This reduces the health risk to off-site residents by eliminating dermal contact and beef ingestion pathways. The removal of on-site soils which contain PCBs and the capping of selected portions of the Site reduces health risks to future on-site maintenance workers or trespassers by preventing dermal contact. The Site buildings are fenced, thereby protecting all but the determined trespasser from exposure to the interior of buildings.

b. Compliance With ARARs

This alternative meets the potential chemical-specific ARAR identified for exposure to PCBs in soil (PCB Spill Cleanup Policy) by capping or removing surface soils with greater than 10 ppm PCBs. The ARAR for exposure to building surfaces with PCBs is met by restricting access to the buildings with fences. The response actions associated with this alternative will be designed to meet the potential action-specific ARARs presented in Appendix B.

c. Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent upon the maintenance of both the Site cap and the building fences as well as strict enforcement of the institutional controls. The cap is a reliable technology if maintained. Fencing, if maintained, is effective in keeping the casual trespasser out of the buildings; however, a determined individual could still gain entry to the building. The institutional controls must be enforced to be effective. The Site requires maintenance and monitoring for at least 30 years or as long as PCB materials remain on-site. The buildings and concrete may have to be removed or cleaned in the future. The residual risk is significant because the Site buildings are not decontaminated and represent a potential health risk to individuals who repeatedly gain entrance to them. In addition, the existing risks associated with vapor inhalation by off-site residents as predicted in the EA remain since the buildings are not cleaned. Although the quantity of PCBs on-site was reduced dramatically by the preliminary removal operations, U.S. EPA review of the Site is required every five years because PCBs remain on-site and U.S. EPA has not established a "de minimus" amount for triggering the 5-year reviews.

d. <u>Reduction Through Treatment</u>

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The materials containing the highest concentrations of PCBs were incinerated, and an estimated 491,000 pounds of PCBs were thus destroyed.

Under this alternative (with landfill option), approximately 6,600,000 pounds of PCB materials will be removed from the Site. Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 195 pounds of PCBs, or 0.04 percent of the quantity of PCBs which has already been destroyed through incineration. The quantity of PCBs remaining on-site after implementation of this alternative is estimated to be less than 3,650 pounds or 0.74 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

e. <u>Short-term Effectiveness</u>

Implementation of this alternative will result in a moderate potential for unacceptable short-term risks to human health. The short-term effectiveness, thus, is directly related to the use of conventional techniques to abate short-term risks to human health and the environment. The use of conventional dust and vapor suppression techniques during response operations minimizes the temporary increase in health risk to the community via inhalation of vapors or dust migrating off-site. The increased local traffic (heavy equipment, dump trucks) also causes an additional risk to the community. Proper planning of Site entrances and exits and scheduling of truck and equipment movement will minimize this risk. On-site workers are protected by use of personal protective equipment (PPE). It is estimated that these temporary risks will exist for approximately six months. It is expected that there will be a disruption of environmental habitats as a result of sediment excavation. These impacts are not expected to be severe because of the low species diversity and the lack of important habitats for spawning of aquatic invertebrate communities in East Pin Oak Creek and its unnamed tributary.

f. Implementability

Implementation of this alternative involves use of proven technologies. The alternative requires equipment which is generally readily available for excavation, construction, treatment, and decontamination. Installation of a multi-media cap requires special materials and technicians. The capping technology is relatively reliable; the fencing of Site buildings is less reliable. The effectiveness of this alternative can be maintained by periodic inspections of the cap and the fencing. If they are intact, the response is still effective. Access agreements with owners of the portions of East Pin Oak Creek and its unnamed tributary proposed for sediment removal must be obtained. Standards must be complied with for discharge of treated surface waters. Installation of a Site cap makes future responses in that area more difficult to implement. Additional cleaning of the buildings can easily be undertaken at a later date. The availability of incinerators could cause a delay in implementation of this alternative. Availability of landfill capacity and acceptance of the PCB materials by out-of-state landfills have not been problems previously, but they could be concerns and limitations in the future. In addition, 40 CFR 268.32, Prohibition on Land Disposal, requires that soils and concrete landfilled after November 8, 1990 contain less than 1,000 mg/kg PCBs. Although portions of the Main Building concrete floor slab exceed this PCB concentration, it is our understanding that the concentration limitation applies to the average concentration for a particular medium. The average PCB concentration in the concrete floor slabs is less than 1,000 mg/kg.

g. Cost

The capital costs and the annual O&M costs of Alternative 3 and the total present worth of these costs are on Table IV-2. The capital costs include main perimeter fencing, building fencing, removal of off- and on-site PCB sediments, removal of on-site ponds, site capping, transportation, and incineration/landfilling. The landfilling costs are based on the expectation that operators will accept low levels (1-2 ppm) of VOCs in the materials to be landfilled. If low levels of VOCs are not acceptable some materials may require pretreatment (aeration or incineration) prior to landfilling. In this case, the cost of off-site landfill disposal could increase significantly. The distance from the Site to the borrow material (for cap construction) has a significant impact on the cost of the cap. Conservative assumptions were used for the cost of capping material.

TABLE IV-2

CAPITAL AND O&M COSTS - ALTERNATIVE 3

Landfilling	Capital Cost	$3,200,000
	Annual O&M	10,000
	Present Worth O&M	160,000
	Present Worth O&M Capital	$3,360,000
Incineration	Capital Cost	$9,400,000
	Annual O&M	10,000
	Present Worth O&M	160,000
	Present Worth O&M and Capital	$9,560,000

D. ALTERNATIVES 4-7: COMMON COMPONENTS

Alternatives 4-7 share certain parts or components in their approaches to the Site response actions. The common components are as follows:

- o Institutional controls
- o PCB sediment removal
- o Site soils removal or capping
- o Final disposal options of PCB materials
- o Use of a decontamination pad

A detailed description of each of these common components is presented in the subsequent paragraphs. These descriptions are not repeated in the individual analyses of the alternatives.

1. INSTITUTIONAL CONTROLS

Institutional controls are used as necessary to restrict future Site use which could put future on-site workers at risk. These may include, but are not limited to:

- Restrictions on future excavations to ensure cap integrity.

- Restrictions on future use of existing buildings to ensure encapsulation integrity.

2. PCB SEDIMENT REMOVAL OR CAPPING

To achieve the health-based objectives for sediments exposure, off- and on-site stream sediments are removed as described in Alternative 3. For on-site pond sediments (and incidental surface water), the sediment may either be removed completely, or capped. Option A of Alternatives 4 and 6 caps the on-site pond sediments, while Option B of Alternatives 4 and 6 removes the on-site pond sediments. Alternative 5 uses only capping; Alternative 7 uses only removal. A small amount of outlying on-site pond sediment is also removed by the capping options. On-site pond sediment is removed until soil is encountered or to a depth of one foot, whichever is greater. Removal of the pond sediments is accomplished using conventional excavation techniques (e.g. front-end loader, backhoe). It is assumed that the pond sediments are dry when excavated, therefore no dewatering is required. For costing purposes, it is assumed that 174 tons of on-site pond sediments are excavated for disposal by the removal option, and 63 tons are removed by the capping option.

The areal extent of stream sediments which require removal is shown on Figure IV-1. Sediment is removed down to the bedrock or one foot, whichever is less. One foot of sediment is conservatively assumed to exist at all locations for costing purposes. Temporary roads are prepared with conventional construction equipment to provide access to some currently inaccessible areas of East Pin Oak Creek and its unnamed tributary.

The discharge from the Holden POTW is routed around the sediment excavation area during removal. A temporary dike also is positioned at the point furthest downstream in East Pin Oak Creek where PCBs were detected in a sediment sample. The dike serves to contain sediments which are disturbed and flow downstream during removal activities. Prior to sediment removal, the surface water remaining in East Pin Oak Creek is collected and pumped to a point downstream of the temporary dike. The pumping is stopped before the removal of this surface water significantly disturbs underlying sediments. Residual water remaining in the creeks during sediment removal will be collected and treated on-site by a carbon adsorption system.

Removal of the stream sediments is accomplished using conventional excavation techniques (e.g., a backhoe or vacuum truck). Where stream access is not feasible, high pressure washing techniques may be used. Removal begins at the point farthest upstream on the unnamed tributary where PCBs were detected in a sediment sample. It is assumed that 853 tons of sediment will be excavated from the unnamed tributary and are transported back to the Site and prepared for transport to an off-site landfill or incinerator. Because the unnamed tributary is normally dry, the sediments excavated from this reach are assumed to require no dewatering.

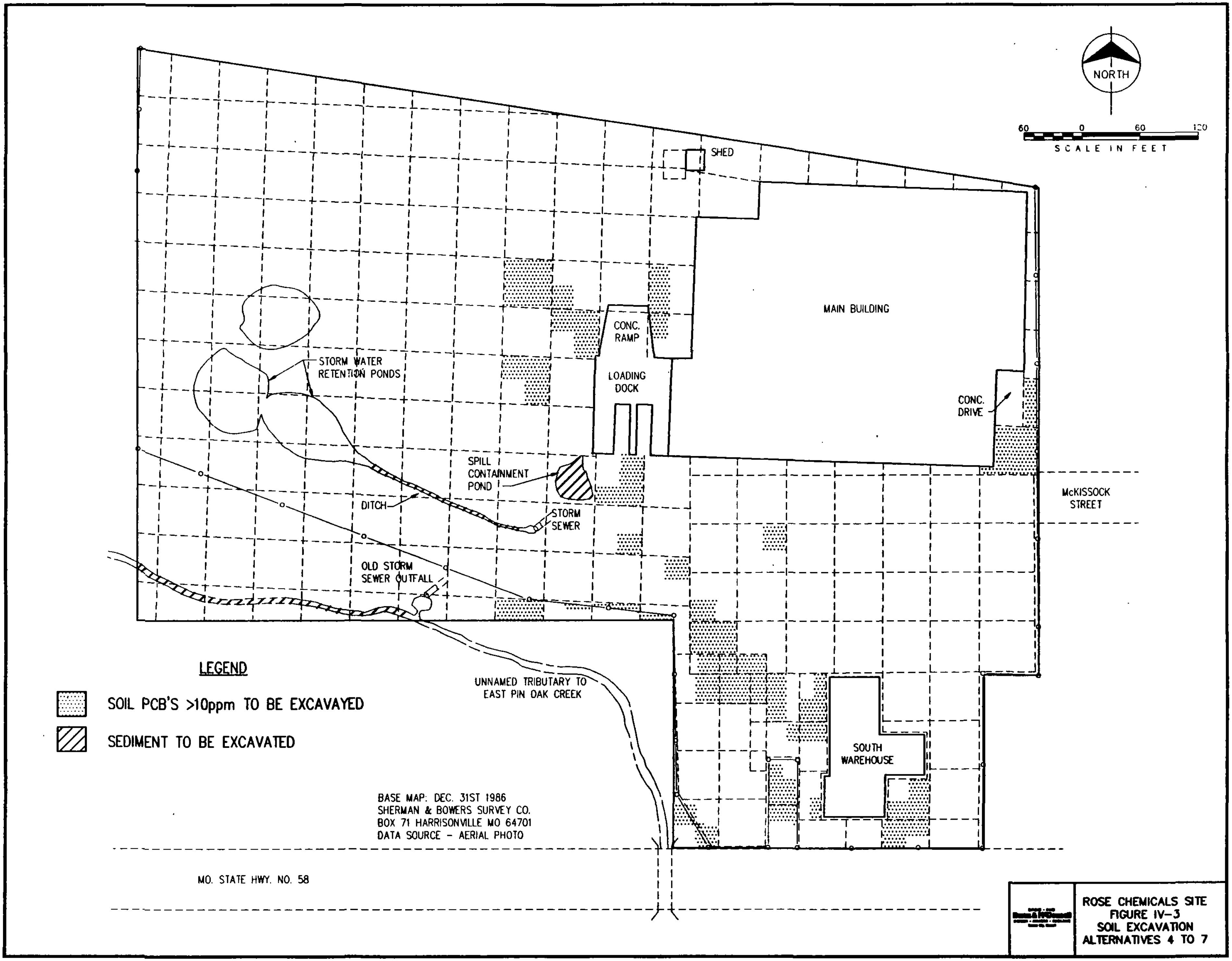
The excavated sediments from East Pin Oak Creek are assumed to require some combination of settling, dewatering, or stabilization. Supernatant water is decanted and treated on-site by a carbon adsorption system. The treated water may be discharged to the unnamed tributary on-site, land-applied on-site, or discharged to the Holden POTW. It is assumed that 470 tons of settled stream sediment from East Pin Oak Creek remain for disposal; and 70,300 gallons of supernatant and residual water are generated for treatment in the carbon adsorption system. In order to transport the sediment, it is assumed that fly ash (or other pozzolanic material) is added to the sediment to dry it. It is assumed that 634 tons of sediment/fly ash material from East Pin Oak Creek are generated for transport to final disposal.

3. SITE SOILS REMOVAL OR CAPPING

To conform to the exposure level given in the PCB Spill Cleanup Policy, persons on-site are not to be exposed to soils with more than 10 ppm PCBs. This can be done in two ways - soil removal or soil containment (capping). Option A of Alternatives 4 and 6 caps the Site PCB soils (>10 ppm), while Option B of Alternatives 4 and 6 removes the Site PCB soils (>10 ppm). Alternative 5 uses only capping; Alternative 7 uses only removal.

The capping option uses the cap described in Alternative 3. The areas to be capped vary and are noted in each specific alternative discussion. Capping is not practical or feasible in PCB soil areas which are not located adjacent to the main body of PCB soils or which are located next to fences or structures. These PCB soils (>10 ppm) are excavated by conventional technologies and may be disposed of off-site or under the Site cap. For conservative costing, off-site disposal is assumed. The quantity of PCB soils (>10 ppm) removed is assumed to be 1,912 tons.

With the removal option, the PCB soils (>10 ppm) are removed using conventional excavation technologies. Figures IV-3 and IV-4 show soil locations to be excavated. For costing purposes, it is assumed that 5,150 tons of soil are excavated for this option. Alternatives 6B and 7 expose additional soil areas by removing the concrete slabs. For these alternatives, an additional 2,331 tons are assumed to be removed. All excavated areas are backfilled with clean soil.



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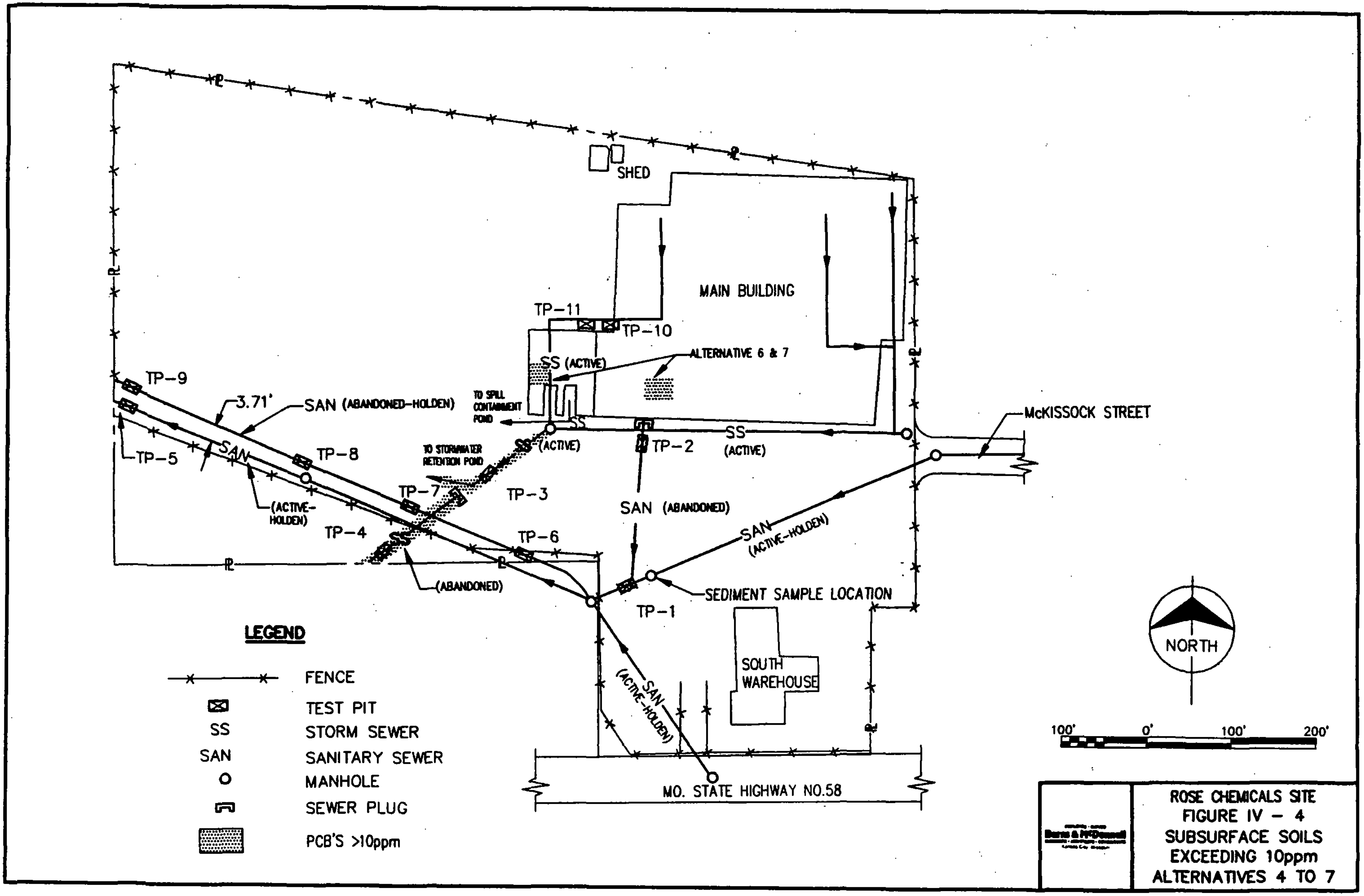


ROSE CHEMICALS SITE
FIGURE IV – 4
SUBSURFACE SOILS EXCEEDING 10ppm
ALTERNATIVES 4 TO 7

ROSE42 9-25-89 S.R.

4. FINAL DISPOSAL OPTIONS OF PCB MATERIALS

Final disposal of removed materials containing PCBs (sediments, excavated soils, building materials, concrete, and spent activated carbon) can be accomplished either by off-site landfilling or by off-site incineration. Land disposal restrictions in 40 CFR 268 currently require that soil or concrete be treated to less than 1,000 mg/kg PCBs prior to landfilling after November 8, 1990. The costs of both landfill and off-site incinceration options are included for each alternative.

5. USE OF A DECONTAMINATION PAD

Each alternative uses a decontamination pad as described in Alternative 3.

E. ALTERNATIVE 4 (OPTION A AND B): REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE OR CAP SITE SOILS; CLEAN BUILDINGS AND CONCRETE

In this alternative, the Site and buildings would be available for future use as a light industrial facility. Under this scenario, the media requiring action to meet the response objectives are:

- o Sediments (health-based objective)
- o Site buildings (health-based objective)
- o Site soils (ARAR-based objective)

1. DESCRIPTION

This alternative removes the stream sediments and removes or caps Site soils as discussed previously in the common components section. It also decontaminates the skin, structural members, and concrete of each building by cleaning them using physical and chemical methods.

The cleaning of a building begins by removing the remaining insulation. For costing purposes, it is assumed that 12 tons of insulation is removed from the Site buildings for disposal. Second, the building skin and framework are washed with high pressure water or steam. Next, if necessary, the skin and framework are cleaned using a chemical solvent. If required, the solvent treatment is repeated until the surfaces are clean, as documented by wipe sampling. For costing purposes, it is assumed that 160,000 square feet of building skin and structural members are to be cleaned and that three iterations of cleaning accomplishes satisfactory cleanup levels.

The concrete slabs are cleaned using physical and chemical means. Areas of concrete that are heavily stained are removed completely. This is assumed to be 10 percent of the total slab area. The remaining concrete slab surfaces are scarified to remove the top 0.25 inches of concrete. The areas are then treated using a chemical solvent cleaning method until PCB levels of 10ug/100cm^2 are reached. Cleanliness is determined by wipe samples. Finally, the slab is sealed with an impervious coating to minimize PCB vaporization. To remain an effective barrier, this coating must not be disturbed. As with the building cleaning, the concrete decontamination may take a number of cleaning iterations before satisfactory cleanup levels are reached. For costing purposes, it is assumed that 614 tons of concrete are completely removed (by demolition or scarification) and that three iterations are required to reach satisfactory cleanup levels.

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative provides similar overall human health and environment protection with regard to off-site sediment and on-site soils as Alternative 3. In addition, it further reduces health risks to future on-site workers or trespassers by removing on-site sediments and by cleaning the Site building structures and concrete.

b. Compliance With ARARs

This alternative would be designed to meet the same ARARs described in Alternative 3. The chemical-specific ARAR identified for exposure to PCB contaminated building surfaces (PCB Spill Cleanup Policy) is attained by cleaning to PCB concentration of less than 10 ug/100 cm^2 instead of restricting access as in Alternative 3.

c. Long-term Effectiveness and Permanence

The long-term effectiveness of Option A is dependent upon the maintenance of the Site cap and the encapsulated concrete, as well as the enforcement of the institutional controls. Because the PCB soils (>10 ppm) remain on-site, the residual risks become significant if there is a failure with any of these controls. The long-term effectiveness is greater with Option B because the PCB soils (>10 ppm) are removed. The removal also reduces the residual risk. However, the concern with the encapsulated concrete remains. Even with a PCB concentration of 10 ug/100 cm^2 in the concrete slab, vapor inhalation represents unacceptable risk. Therefore, in order to protect human health, the concrete sealant must be vapor-proof and the long term reliability of the vapor seal is unknown. The long-term reliability of the multi-media cap (Option A) also is uncertain. Option B provides greater long-term effectiveness because PCB soils are removed from the Site. Although this alternative provides some future use (e.g., light industrial facility), there may not be a practical use for the Site given the restrictions placed upon it and possible liability concerns of future occupants. Because of these concerns, the buildings may have to be removed or cleaned further in the future. Prior to use, the Site buildings would have to be repaired and insulated. These improvements are not considered in the study. An agency review of the Site will be necessary every five years because PCBs remain on-site.

d. Reduction Through Treatment

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The materials containing the highest concentrations of PCBs were incinerated and an estimated 491,000 pounds of PCBs were thus destroyed.

Under Alternative 4A (with landfill option), approximately 7,820,000 pounds of PCB materials will be removed from the Site. Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 3,095 pounds of PCBs, or 0.6 percent of the quantity of PCBs which have already been destroyed by incineration. The quantity of PCBs remaining on-site after implementation of Alternative 4A is estimated to be less than 752 pounds or 0.15 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

Under Alternative 4B (with landfill option), approximately 14,500,000 pounds of PCB materials will be removed from the Site. Again, these materials contain relatively low concentrations of PCBs, and the removal would result in off-site landfilling of approximately 3,330 pounds of PCBs, representing 0.7 percent of the quantity of PCBs which has already been destroyed through incineration. The quantity of PCBs remaining on-site after implementation of Alternative 4B is estimated to be less than 521 pounds or 0.11 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

Some discussion of the reappearance of oil stains on previously cleaned concrete floors should be included. - How long to wait before sampling

e. Short-term Effectiveness

Implementation of Option A of this alternative will result in a moderate potential for unacceptable short-term risks to human health. Due to the greater quantity of material to be excavated in Option B, the potential for unacceptable risks is incrementally greater for Option B than for Option A but still remains in the moderate range. The short-term risks to human health and the environment due to the implementation of this alternative can be minimized using the same techniques as described in Alternative 3. Additional on-site worker protective measures are necessary to decrease the risk associated with the cleaning of the buildings and concrete. The environmental effects due to sediment removal will be the same as discussed for Alternative 3. It is estimated that these temporary risks will last about six months.

f. Implementability

This alternative uses the same proven technologies as Alternative 3. In addition, cleaning technologies are used to clean buildings and concrete. The cleaning technologies are not technically complex, but their effectiveness may be uncertain. Cleaning of the metal portions of the buildings should be reasonably effective; cleaning of the concrete floors may not be effective due to the porosity of the concrete. The effectiveness of the cleanup depends upon (1) the concentration of PCBs present, (2) the depth of PCBs in the concrete, and (3) the reliability of the sampling program used to determine whether satisfactory cleanup levels have been reached.

These technologies require specially trained technicians, and special precautions must be taken to contain water and solvent used for cleaning. As described, this cleaning procedure is iterative, and its costs approach that of total demolition of the building and structures after a number of iterations. In addition, the reliability of the final sealant as a vapor barrier is unknown. Installation of a multi-media cap (Option A) also requires special materials and technicians and makes future response actions more difficult to implement without damaging the cap. Access to the buildings for additional cleaning should not be a problem. The effectiveness of this alternative can be monitored by sampling and analyzing environmental samples of sediment, soil, air, and building and concrete surfaces. Access and discharge agreements as described in Alternative 3 must be obtained. Approval of regulatory agencies may not be readily obtained because of concern about the effectiveness of the concrete encapsulation. Incinerator and landfill issues discussed in Alternative 3 also apply.

g. Cost

The capital costs and the annual O&M costs of Alternative 4, and the present total worth of these costs are listed in Table IV-3. The capital costs include removal of off- and on-site PCB sediments, main perimeter fencing, removal of on-site ponds, building decontamination, capping (Option A), PCB soils removal (Option B), transportation, and incineration/landfilling. The cost concerns discussed in Alternative 3 for landfilling, incinerating, and capping also apply to this alternative. In addition, the iterative nature of the cleaning procedure means the cleaning cost could be significantly increased if the initial cleaning attempts are unsuccessful.

TABLE IV-3

CAPITAL O&M COSTS - ALTERNATIVE 4

Option A - Capping

Landfilling	Capital Cost	$ 6,800,000
	Annual O&M	9,600
	Present Worth O&M	150,000
	Present Worth O&M Capital	$ 6,850,000
Incineration	Capital Cost	$14,000,000
	Annual O&M	9,600
	Present Worth O&M	150,000
	Present Worth O&M and Capital	$14,150,000

Option B - Removal

Landfilling	Capital Cost	$ 9,000,000
	Annual O&M	3,200
	Present Worth O&M	50,000
	Present Worth O&M and Capital	$ 9,050,000
Incineration	Capital Cost	$22,400,000
	Annual O&M	3,200
	Present Worth O&M	50,000
	Present Worth O&M and Capital	$22,450,000

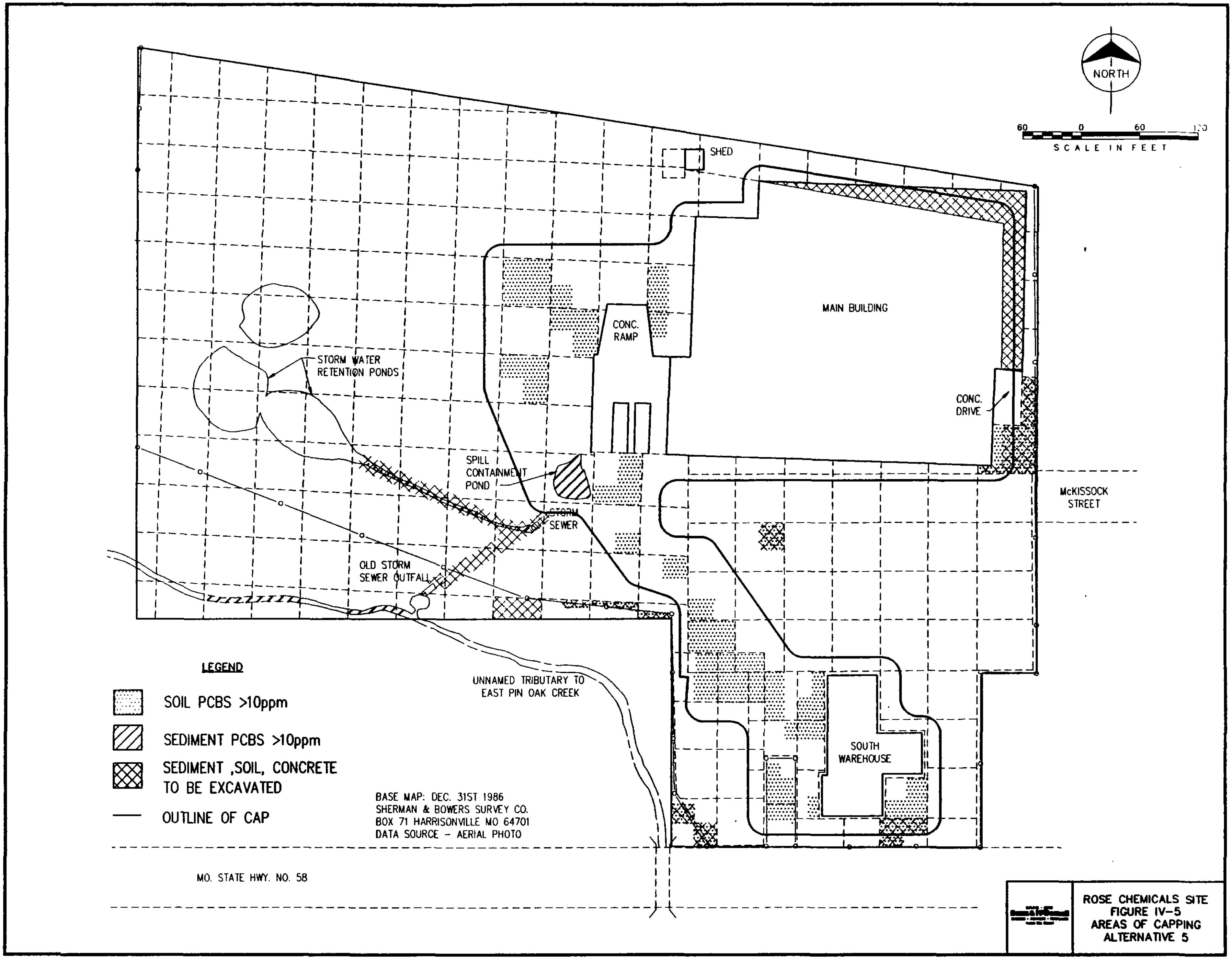
F. ALTERNATIVE 5: REMOVE OFF- AND ON-SITE PCB SEDIMENTS; CAP SITE SOILS AND CONCRETE; REMOVE BUILDINGS

Under this alternative, limited portions of the Site would be available for future light industrial use. The media requiring action are sediments, Site soils, and Site buildings.

1. DESCRIPTION

This alternative consists of the same activities as Alternative 4 (Option A) except that this alternative removes the building skin and structural members and leaves the concrete slabs intact. Neither building structure nor concrete are cleaned; however, the concrete slab will be sprayed with polymers to minimize volatile emissions. The multi-media cap is expanded to include the concrete slabs. Only these distinctions from Alternative 4A and their effect on the criteria assessment are presented here.

The building structures are removed by conventional demolition techniques. This includes removal of all remaining insulation, building skin, lighting and wiring, piping, and above-grade structures. For costing purposes it is assumed that there are 558 tons of these materials. The removed building materials are landfilled. The remaining concrete slabs are left in place. The area of the Site capped by the multi-media cover in Alternative 4 (Option A) is expanded to include the concrete. Figure IV-5 shows the area covered by the cap in this alternative. For costing purposes it is assumed that the area to be capped is 275,000 square feet.



ROSE CHEMICALS SITE
FIGURE IV-5
AREAS OF CAPPING
ALTERNATIVE 5

ROSE44 10-10-89

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative protects human health and the environment with respect to sediment and soil in the same manner as Alternative 4. In addition, this alternative further reduces health risks to trespassers by removing the buildings and by capping the remaining concrete slabs. This method of limiting exposure to the buildings and concrete is more reliable than the method of Alternative 4. Removal of the building significantly reduces the moderate existing risk to off-site residents due to vapor inhalation.

b. Compliance with ARARs

This alternative meets the same potential ARARs described in Alternative 4.

c. Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent upon the maintenance of the Site cap and on the enforcement of the institutional controls. The residual risks are moderate if there is a failure of these controls. There is uncertainty associated with the long-term reliability of the multi-media cap. An agency review of the Site is required every five years since PCBs remain on-site.

d. Reduction Through Treatment

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The materials containing the highest concentrations of PCBs were incinerated, and an estimated 491,000 pounds of PCBs were thus destroyed.

Under this alternative (with landfill option), approximately 9,330,000 pounds of PCB materials will be removed from the Site. Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 260 pounds of PCBs, or 0.05 percent of the quantity of PCBs which has already been destroyed by incineration. The quantity of PCBs remaining on the Site after implementation of Alternative 5 is estimated to be less than 3,590 pounds or 0.72 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

e. Short-term Effectiveness

Implementation of this alternative will result in a moderate potential for unacceptable short-term risks to human health. The same temporary increase in health risk to the community and on-site workers and environmental impact as described in Alternative 3 would be expected with an incremental increase in the risk to on-site workers due to the building demolition activities. This risk is reduced by using adequate health and safety measures during demolition. It is estimated that these temporary risks will last about six months.

f. Implementability

The same conclusions regarding implementability reached in the analysis of Alternative 3 apply here. This alternative uses the same proven response technologies as well as conventional demolition technologies associated with the building removal. Installation of a multi-media cap requires special materials and technicians. Its presence makes potential future Site responses more difficult. The effectiveness of this alternative can be monitored by sampling and analyzing environmental samples of sediment, soil, and air. Access and water discharge agreements as described in Alternative 3 must be obtained. Incinerator and landfill issues discussed in Alternative 3 also apply to this alternative.

g. Cost

The capital costs and the annual O&M costs of Alternative 5 and the total present worth of these costs are on Table IV-4. The capital costs include off- and on-site PCB sediment removal, demolition of ponds, main perimeter fencing, capping, transportation, and incineration/landfilling. The landfilling, capping, and incinerating costs are based on the same factors described in Alternative 3.

TABLE IV-4

CAPITAL AND O&M COSTS - ALTERNATIVE 5

Landfilling	Capital Cost	$ 5,600,000
	Annual O&M	15,900
	Present Worth O&M	240,000
	Present Worth O&M and Capital	$ 5,840,000
Incineration	Capital Cost	$14,400,000
	Annual O&M	15,900
	Present Worth O&M	240,000
	Present Worth O&M and Capital	$14,640,000

G. ALTERNATIVE 6 (OPTION A AND B): REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE OR CAP SITE SOILS; CLEAN BUILDINGS AND REMOVE CONCRETE

This alternative is designed to achieve the same future use scenario (industrial) as Alternatives 4 and 5. Therefore, the same media (sediments, Site soils, and Site buildings) require action to meet the response objectives.

1. DESCRIPTION

This alternative consists of the same response techniques as Alternative 4 except that this alternative removes the concrete slab, leaving the building skin and structural members intact. Because of the similarities of this alternative to Alternative 4, only the effects of removing the concrete slabs on the criteria assessment are presented here. As discussed previously, Option A of this alternative caps the PCB soils (>10 ppm) and Option B removes them.

The concrete is removed by conventional demolition techniques. Concrete footings necessary for the structural integrity of the buildings are remediated to the extent possible and left in place. After the removal of concrete, the exposed soils are sampled using a grid system much like was used during the RI. Areas are removed which contain greater than 10 ppm PCBs to a depth of four inches. The area is then resampled to determine the extent of any residual PCB concentrations. This iterative process is continued until all areas contain less than 10 ppm PCBs. This generates 1,681 tons of soil for disposal assuming that 25 percent of the soil area is contaminated to a depth of one foot. The excavated areas are backfilled with clean soil. After removal of the slab and soil, the building skin and framework are cleaned with the techniques described in Alternative 4. Special attention is given to collecting the washing fluid.

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative protects human health and the environment by the same response techniques as Alternative 4. In addition, this alternative further reduces health risks to future on-site workers or trespassers by removing the concrete slabs from the Site.

b. Compliance with ARARs

This alternative meets the same ARARs described in Alternative 4.

c. Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent upon the maintenance of the Site cap (for Option A) and the remaining encapsulated concrete footings, as well as the enforcement of the institutional controls. The residual risks are moderate if there is a failure with any of these controls. There is uncertainty associated with the long-term reliability of the multi-media cap under Option A, the concrete encapsulant, and the future vapor protection provided with a new concrete floor slab (which would be provided by the new occupant of the building). Option B provides greater long-term effectiveness because PCB soils (>10 ppm) are removed from the Site. The residual risk is not as great as Alternative 4 because a greater amount of material (concrete) has been removed from the Site. Although this alternative provides some future use possibilities (i.e., light industrial facility), there may not be a practical use for the Site given the restrictions placed upon it. The buildings may have to be cleaned further in the future. An agency review of the Site is required every five years since PCBs remain on-site.

d. Reduction Through Treatment

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The material containing the highest concentrations of PCBs were incinerated, and an estimated 491,000 pounds of PCBs were thus destroyed.

Under Alternative 6A (with landfill option), approximately 15,680,000 pounds of PCB materials will be removed from the Site.

Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 3,195 pounds of PCBs or 0.7 percent of the quantity of PCBs which has already been destroyed by incineration. Implementation of this alternative would leave an estimated 650 pounds of PCBs on the Site, or approximately 0.13 percent of the total PCBs on the Site at the time the RCSC took control.

Under Alternative 6B (with landfill option), approximately 27,040,000 pounds of PCB materials will be removed from the Site. Again, these materials contain relatively low concentrations of PCBs, and the removal would result in off-site landfilling of approximately 3,528 pounds of PCBs, representing 0.7 percent of the quantity of PCBs which has already been destroyed through incineration. The quantity of PCBs remaining on the Site after implementation of Alternative 6B is estimated to be less than 320 pounds or 0.06 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

e. <u>Short-term Effectiveness</u>

Implementation of this alternative will result in a moderate potential for unacceptable short-term risk to human health. The same temporary increase in health risk to the community and to on-site workers and in environmental impact as described in Alternative 3 would be expected with an incremental increase in the risk to on-site workers due to the building demolition activities. This risk is reduced by using adequate safety measures during demolition. These temporary risks are estimated to last about six months.

f. Implementability

The same conclusions from Alternative 4 and 5 with regard to implementability (ability to construct and operate, to monitor effectiveness, and to obtain approvals; limitations on additional response actions; availability of technology; and landfill and incineration issues) apply to this alternative. This alternative uses the same technologies as Alternative 4 as well as the conventional demolition technologies associated with the concrete removal described in Alternative 5. Because the slab demolition occurs within the building, the size and type of equipment which can be used is limited. However, this smaller equipment is readily available on the commercial market.

g. Cost

The capital costs and the annual O&M costs of Alternative 6, and the present worth of these costs are listed in Table IV-5. The capital costs include main perimeter fencing, removal of off- and on-site PCB sediments, removal of on-site ponds, decontamination of buildings, removal of concrete, capping (Option A), removal of PCB soils (Option B), transportation, and incineration/landfilling. The landfilling and capping costs are based on the same factors described in Alternative 3. The costing recognizes that slab removal will be accomplished inside the building.

TABLE IV-5

CAPITAL AND O&M COSTS - ALTERNATIVE 6

Option A - Capping

Landfilling	Capital Cost	$ 8,400,000
	Annual O&M	9,600
	Present Worth O&M	150,000
	Present Worth O&M and Capital	$ 8,450,000
Incineration	Capital Cost	$22,800,000
	Annual O&M	9,600
	Present Worth O&M	150,000
	Present Worth O&M and Capital	$22,850,000

Option B - Removal

Landfilling	Capital Cost	$12,200,000
	Annual O&M	3,200
	Present Worth O&M	50,000
	Present Worth O&M and Capital	$12,250,000
Incineration	Capital Cost	$36,800,000
	Annual O&M	3,200
	Present Worth O&M	50,000
	Present Worth O&M and Capital	$36,850,000

H. ALTERNATIVE 7: REMOVE OFF- AND ON-SITE PCB SEDIMENTS; REMOVE SITE SOILS, BUILDINGS, AND CONCRETE

This alternative is designed to allow future use of the Site as an industrial park. A restriction is placed on future use in that the new buildings must have 20-foot ceilings and a minimum air exchange rate of one volume per hour or that the new buildings must be constructed with an adequate vapor seal or a foundation vapor collection and removal system. The media requiring action include sediments, Site soils, and Site buildings.

1. DESCRIPTION

This alternative consists of the same activities as Alternative 4B except that this alternative removes the buildings and all concrete from the Site instead of cleaning them. This alternative does not have a multi-media cap option. Only the differences of this alternative from Alternative 4 are described in detail.

The buildings and concrete are removed using conventional demolition methods. For costing purposes, 5,098 tons of building and concrete material are assumed to be disposed of. After the removal of the buildings and concrete, the exposed soils are sampled using a grid system much like that used during the RI. Areas are removed which contain greater than 10 ppm PCBs to a depth of four inches. The area is then resampled to determine the extent of any residual PCB concentrations. This iterative process is continued until all areas contain less than 10 ppm PCBs. This generates 1,681 tons of soil for disposal assuming that 25 percent of the soil area is contaminated to a depth of one foot. Excavated areas are backfilled with clean soil.

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative protects human health and the environment by the same methods as Alternative 4. In addition, this alternative further reduces health risks to future Site users by removing the buildings and concrete from the Site.

b. Compliance with ARARs

This alternative meets the same ARARs described in Alternative 3.

c. Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is dependent upon enforcement of the institutional controls (building restriction). The reliability of the response is good because soils and building materials containing PCBs are removed. The residual risks are low if there is a failure of these controls. An agency review of the Site will be needed every five years since PCBs remain on-site.

d. Reduction Through Treatment

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The materials containing the highest concentrations of PCBs were incinerated, and an estimated 491,000 pounds of PCBs were thus destroyed.

Under this alternative (with landfill option), approximately 28,150,000 pounds of PCB materials will be removed from the Site. Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 3,528 pounds of PCBs, or 0.7 percent of the quantity of PCBs which has already been destroyed through incineration. The quantity of PCBs remaining on the Site after implementation of Alternative 7 is estimated to be less than 320 pounds or 0.06 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

e. Short-term Effectiveness

Implementation of this alternative will result in a moderate potential for unacceptable short-term risks to human health. The same temporary increase in health risk to the community and on-site workers and in environmental impact as described in Alternative 3 would be expected, with an incremental increase in the risk to on-site workers due to the building demolition activities. This risk is reduced by using adequate health and safety measures during demolition. It is estimated that these temporary risks will last about six months.

f. Implementability

The same conclusions from Alternatives 3 and 5 with regard to implementability (ability to construct and operate, to monitor effectiveness, and to obtain approvals; ease of additional response action; availability of technology; and landfill and incineration issues) apply to this alternative. This alternative uses the same technologies as Alternative 5 as well as the conventional demolition technologies associated with the concrete removal described in Alternative 6.

g. Cost

The capital costs and the annual O&M costs of Alternative 7 and the total present worth of these costs are on Table IV-6. The capital costs include removal of off- and on-site PCB sediments, demolition of ponds, removal of PCB soils, demolition/removal of buildings and concrete, transportation, and incineration/ landfilling. The landfilling and incineration costs are based on the same factors described in Alternative 3.

TABLE IV-6

CAPITAL AND O&M COSTS - ALTERNATIVE 7

Landfilling	Capital Cost	$11,500,000
	Annual O&M	1,800
	Present Worth O&M	30,000
	Present Worth O&M and Capital	$11,530,000
Incineration	Capital Cost	$37,200,000
	Annual O&M	1,800
	Present Worth O&M	30,000
	Present Worth O&M and Capital	$37,230,000

I. ALTERNATIVE 8: COMPLETE REMOVAL OF OFF- AND ON-SITE PCB SEDIMENTS, SITE SOILS, CONCRETE, BUILDINGS AND SEWERS

In this alternative, the Site would be available for unrestricted future use. Under this scenario, the media requiring action to meet the response objectives are:

- Sediments (health-based objective)

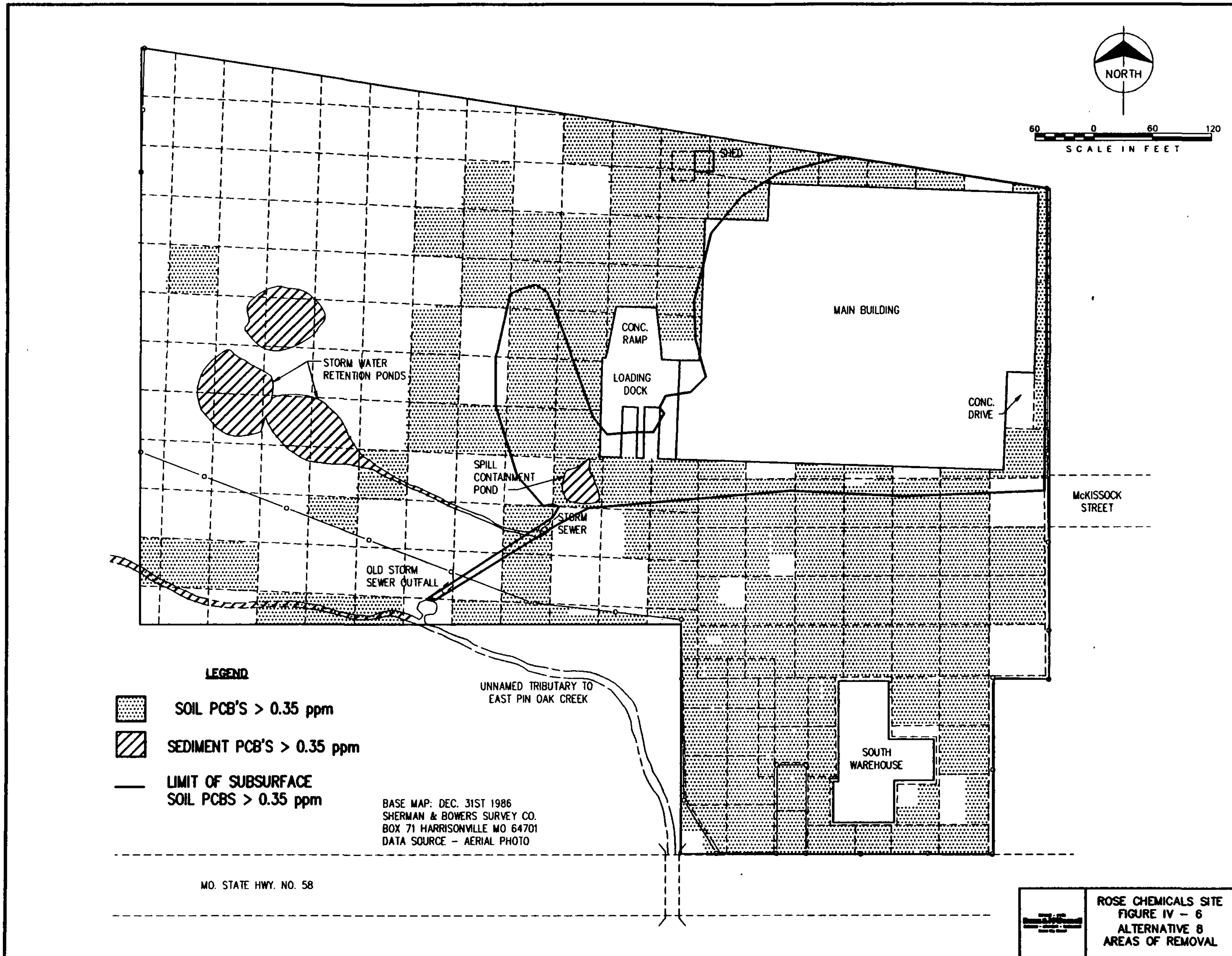
- o Site buildings (health-based objective)
- o Site soils (health-based objective)

1. DESCRIPTION

This alternative combines the activities of Alternative 3, except for the Site cap, with the following activities:

- o Excavation of additional soils so that remaining soils contain below 0.35 ppm total PCBs,
- o Backfilling of the excavations with clean soil,
- o Selective removal of abandoned on-site sewers,
- o Complete removal of the buildings and concrete from the Site.

The areal extent of the Site soils (including selected on-site sewers) removed by this alternative are shown in Figure IV-6. The process of removing the soils is iterative. After removing soil to a prescribed depth, the area is sampled to determine whether the required cleanup level is reached. If not, another layer of soil is removed. Once the required cleanup level is reached, precautions must be taken to avoid cross-contamination between clean areas and areas still containing PCBs above 0.35 ppm. For costing purposes, it is assumed that the soil is removed to bedrock. This activity generates 131,000 tons of soil for disposal. Removal is accomplished using standard excavation equipment and methods. The excavated areas are backfilled with clean soil.



ROSE CHEMICALS SITE
FIGURE IV – 6
ALTERNATIVE 8
AREAS OF REMOVAL

The buildings and concrete are removed as described in Alternative 7.

As with previously described alternatives, materials generated during removal activities may be disposed of either by off-site landfilling or off-site incineration.

No institutional actions are necessary for this alternative.

2. CRITERIA ASSESSMENT

a. Overall Protection

This alternative protects human health and the environment by achieving cleanup levels that allow unrestricted future Site use. Removal of all media containing PCBs reduces the health risks to acceptable levels for all scenarios described in Part II.

b. Compliance with ARARs

This alternative meets the same ARARs described in Alternative 3.

c. Long-term Effectiveness and Permanence

This alternative achieves long-term effectiveness by removing all materials that are a threat to human health or the environment. No residual risk remains. No Site controls are necessary. There is no requirement for an agency five-year review.

d. <u>Reduction Through Treatment</u>

During the preliminary cleanup operations, the RCSC removed approximately 19,700,000 pounds of materials containing relatively high concentrations of PCBs. The materials containing the highest concentrations of PCBs were incinerated, and an estimated 491,000 pounds of PCBs were thus destroyed.

Under this alternative (with landfill option), approximately 284,000,000 pounds of PCB materials will be removed from the Site. Because these materials contain much lower concentrations of PCBs, the removal would result in off-site landfilling of approximately 3,747 pounds of PCBs, or 0.8 percent of the quantity of PCBs which has already been destroyed through incineration. The quantity of PCBs remaining on the Site after implementation of Alternative 8 is estimated to be less than 100 pounds or 0.02 percent of the total PCBs on the Site at the time the RCSC took control of the Site.

e. <u>Short-term Effectiveness</u>

Because of the large amount of material removed and an estimated 18-month schedule, implementation of this alternative will result in a high potential for unacceptable short-term risks to human health. This risk is reduced by using conventional dust and vapor suppression techniques. On-site workers are also at risk due to the excavation and demolition activities. This risk is reduced by using adequate safety measures during demolition and PPE. Limited environmental impacts, as discussed under Alternative 3 for sediment removal, are expected.

f. Implementability

The same conclusions from Alternatives 3 and 5 with regard to implementability (ability to construct and operate, to monitor effectiveness, and to obtain approvals; ease of additional response action; availability of technology; and landfill and incineration issues) apply to this alternative. In addition, capacity of off-site facilities to handle the increased quantities is a concern. The amount of soil for disposal (131,000 tons) leads to a concern of whether a landfill or incinerator would accept this amount of soil which is relatively low level PCB material. This alternative uses the same technologies as Alternative 5 as well as the conventional demolition technologies associated with the concrete removal described in Alternative 6.

g. Cost

The capital costs and the annual O&M costs of Alternative 8 and the total present worth of these costs are on Table IV-7. The capital costs include removal of off- and on-site PCB sediments, demolition of ponds, removal of PCB soils, demolition and removal of buildings and concrete, removal of sewers, transportation, and incineration/landfilling. The costs are based on the same factors described in Alternative 3.

TABLE IV-7

CAPITAL AND O&M COSTS - ALTERNATIVE 8

Landfilling	Capital Cost	$102,100,000
	Annual O&M	0
	Present Worth O&M	0
	Present Worth O&M and Capital	$102,100,000
Incineration	Capital Cost	$359,400,000
	Annual O&M	0
	Present Worth O&M	0
	Present Worth O&M and Capital	$359,400,000

J. COMPARATIVE ANALYSIS

The final part of this detailed analysis is a comparison of the alternatives so that relative advantages and disadvantages of each alternative can be evaluated. This comparison is made on a criterion-specific basis. As suggested by EPA Guidance, alternatives are generally presented in order of best compliance within each specific criterion discussion. State and community acceptance will be addressed in the Record of Decision (ROD) following comments on the RI/FS reports and the proposed remedial alternative. Tables IV-8 through IV-15 contain summaries of all alternative-specific information.

TABLE IV-8
SUMMARY OF COMPARATIVE ANALYSIS - OVERALL PROTECTION
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Human Health Protection	Environmental Protection
1	No Action	Minimal reduction in risk.	No significant risk to the environment.
3	Remove off-site PCB sediments; cap Site.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser reduced by soil barrier. Risk to determined on-site trespasser from building exposure remains.	Surface barrier reduces air emissions from the soils containing PCBs. Alternative removes contaminants from stream.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by surface barrier and building and concrete cleaning.	See Alternative 3. Also eliminates air emissions from the buildings through remediation.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by soil removal and building and concrete cleaning.	See Alternative 4 (Option A). Also removes soils containing PCBs from Site.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by surface barrier and building cleaning and concrete capping.	See Alternative 4 (Option A).
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by surface barrier and building cleaning and concrete removal.	See Alternative 4 (Option A).
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by soil removal and building cleaning and concrete removal.	See Alternative 4 (Option B).
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	Risk to off-site residents eliminated by sediment removal. Risk to on-site trespasser or industrial worker reduced by soil removal and building and concrete removal.	See Alternative 4 (Option B).
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	Risk to off-site residents and on-site trespasser, worker, and resident eliminated by complete sediment, soil, building, and concrete removal.	Complete restoration of the environment by removal of all PCB materials.

TABLE IV-9
SUMMARY OF COMPARATIVE ANALYSIS - COMPLIANCE WITH ARARS
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Chemical-Specific ARARs	Action-Specific ARARs	Location-Specific ARARs
1	No Action	Does not meet EPA PCB Spill Cleanup Policy levels in soils or on surfaces.	Meets all ARARs (see Appendix B).	No location specific ARARs were identified.
3	Remove off-site PCB sediments; cap Site.	Would meet Spill Cleanup Policy exposure levels using Institutional Actions.	See Alternative 1.	See Alternative 1.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	Would meet Spill Cleanup Policy exposure levels for soils and surfaces.	See Alternative 1.	See Alternative 1.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	See Alternative 4 (Option A).	See Alternative 1.	See Alternative 1.

TABLE IV-10
SUMMARY OF COMPARATIVE ANALYSIS - LONG-TERM EFFECTIVENESS AND PERMANENCE
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Magnitude of Residual Risk	Adequacy and Reliability of Controls	Need for 5-Year Review
1	No Action	Risks identified by the Endangerment Assessment remain.	Controls for PCB exposure are inadequate.	Review is required to ensure adequate protection of human health and the environment.
3	Remove off-site PCB sediments; cap Site.	Risks associated with the buildings and concrete remain since they are not remediated.	Controls of exposure to sediment and surface soil are adequate. Control of exposure to buildings and concrete is inadequate.	See Alternative 1. On-site surface and subsurface soils, sediments, and buildings and concrete containing PCBs remain on-site.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	Risks controlled as long as building and concrete cleaning is successful, any encapsulant used on the concrete is maintained, and the Site cap is maintained.	Exposure controls are adequate. Reliability of cap is high if maintained. Reliability of institutional controls on building and concrete use are uncertain.	See Alternative 1. On-site surface and subsurface soils, and concrete containing PCBs remain on-site.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	See Alternative 4 (Option A).	See Alternative 4 (Option A).	See Alternative 4 (Option A), except that soils are removed.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	Risks controlled as long as Site cap is maintained.	Exposure controls are adequate. Reliability of cap is high if maintained.	See Alternative 4 (Option A).
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	Risks controlled as long as building cleaning is successful, and the Site cap is maintained.	Exposure controls are adequate. Reliability of cap is high if maintained. Reliability of institutional controls on building use are uncertain.	Same as Alternative 4 (Option A), except that concrete has been removed from the Site.
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	Risks controlled as long as building cleaning is successful.	Exposure controls are adequate. Reliability of institutional controls on buildings are uncertain.	See Alternative 4 (Option A), except that only soils with less than 10 ppm PCBs remain on-site.
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	Risks controlled as long as institutional control is maintained.	Exposure controls are adequate. Reliability of control is high if building restrictions are maintained.	See Alternative 6 (Option B).
8	Complete removal of off- and on-site PCB sediments, soils, concrete, buildings, and sewers.	There are no significant residual risks associated with this alternative.	No controls necessary.	No need for 5-year review because nearly all contaminants are removed from the Site.

TABLE IV-11
SUMMARY OF COMPARATIVE ANALYSIS - REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Treatment Process Used	Amount Destroyed or Treated	Reduction of Toxicity, Mobility or Volume	Irreversible Treatment	Residuals Remaining After Treatment	Statutory Preference for Treatment
1	No action beyond preliminary removal operations.	Preliminary removal operation incinerated PCB liquids and materials.	Preliminary removal operations incinerated 491,000 pounds of PCBs.	Preliminary removal operation reduced the volume and toxi- of the PCBs.	Incineration is irreversible.	Incinerator ash.	Satisfies.
3	Remove off-site PCB sediments; cap Site.	See Alternative 1; also treatment of waters with activated carbon.	See Alternative 1; also all surface water are treated.	See Alternative 1; also mobility of PCBs in surface waters reduced.	Carbon treatment and incineration are irreversible.	See Alternative 1.	Satisfies.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	Same as Alternative 3, except buildings and concrete are cleaned by physical and chemical methods.	See Alternative 3. Buildings and concrete are also treated.	See Alternative 3. Also, reduced toxicity and volume of PCB contaminated building and concrete materials.	See Alternative 3.	See Alternative 1.	Satisfies.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	See Alternative 4 (Option A).	See Alternative 4 (Option A).	See Alternative 4 (Option A).	See Alternative 3.	See Alternative 1.	Satisfies.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 1.	Satisfies.
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	Same as Alternative 3, except buildings are cleaned by physical and chemical methods.	See Alternative 3. Buildings are also treated.	See Alternative 3. Also, reduced toxicity and volume of PCB contaminated building materials.	See Alternative 3.	See Alternative 1.	Satisfies.
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	See Alternative 6 (Option A).	See Alternative 6 (Option A).	See Alternative 6 (Option A).	See Alternative 3.	See Alternative 1.	Satisfies.
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 1.	Satisfies.
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 3.	See Alternative 1.	Satisfies.

TABLE IV-12
SUMMARY OF COMPARATIVE ANALYSIS - SHORT-TERM EFFECTIVENESS
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Community Protection	Worker Protection	Environment Impacts	Time Until Action is Complete
1	No Action	Low potential for unacceptable health risks by current condition.	Not applicable.	No significant environmental impacts.	Fencing is complete within one month.
3	Remove off-site PCB sediments; cap Site.	Moderate potential for unacceptable health risk is abated by vapor and dust suppression during construction.	On-site workers are protected from dermal contact and dust or vapor inhalation by PPE and proper construction techniques.	Disruption of stream environment occurs but impact is not significant.	Removal and construction activities complete within four months.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal, cleaning, and construction activities are complete within six months.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal and cleaning activities are complete within six months.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal and construction activities are complete within six months.
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal and construction activities are complete within six months.
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal activities are complete within six months.
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	See Alternative 3.	See Alternative 3.	See Alternative 3.	Removal activities are complete within six months.
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	High potential for unacceptable health risk is abated by vapor and dust suppression during construction.	See Alternative 3.	See Alternative 3.	Removal activities are complete within eighteen months.

TABLE IV-13
SUMMARY OF COMPARATIVE ANALYSIS - IMPLEMENTABILITY
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Ability to Construct and Operate	Ease of Undertaking Additional Remediation	Ability to Monitor Effectiveness	Ability to Obtain Approvals	Technology Availability
1	No Action	No construction or operation.	RI/FS process may have to be repeated if no action is taken now.	Not applicable.	No approval necessary.	None Required.
3	Remove off-site PCB sediments; cap Site.	Alternative uses conventional technologies and materials.	Multi-media cap makes performing additional remediation of soils difficult. Buildings and concrete can be easily remediated in the future.	Effectiveness is assessed by sampling soil and sediment and monitoring cap integrity.	May need approval to discharge water to POTW. Will need access agreements to adjoining properties.	Incineration and landfill issues are only concerns.
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	Same as Alternative 3 with the addition of surface cleaning techniques. The surface cleaning requires more complex operation techniques.	See Alternative 3.	See Alternative 3. Also, effectiveness of cleaning is assessed by surface sampling of cleaned buildings and concrete.	See Alternative 3.	See Alternative 3.
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	See Alternative 4 (Option A).	See Alternative 3, except soil is removed.	See Alternative 4 (Option A).	See Alternative 3.	See Alternative 3.
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	See Alternative 3.	See Alternative 3, expect buildings are removed.	See Alternative 3.	See Alternative 3.	See Alternative 3.
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	See Alternative 4 (Option A).	See Alternative 3, but concrete is removed.	See Alternative 4 (Option A).	See Alternative 3.	See Alternative 3.
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	See Alternative 4 (Option A).	Building can be easily remediated in the future.	See Alternative 4 (Option A).	See Alternative 3.	See Alternative 3.
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	See Alternative 3.	Probability of future remediation is low.	See Alternative 3.	See Alternative 3.	See Alternative 3.
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	See Alternative 3.	This alternative is complete. No additional remediation will be necessary.	See Alternative 3.	See Alternative 3.	See Alternative 3.

1. OVERALL PROTECTION

All of the alternatives, except for Alternative 1, protect human health and the environment by either removing or preventing exposure to PCB materials. All of the alternatives, except for Alternative 1, remove PCB sediments from East Pin Oak Creek and its unnamed tributary, thus eliminating the exposure pathway to off-site residents. The alternatives deal with the remaining PCB materials on-site by a variety of methods. These methods include complete removal, partial removal, cleaning, and capping.

Alternative 8 provides overall protection by removing practically all PCB materials from the Site. Alternative 8 is the only alternative which allows unrestricted future use of the Site. Alternative 7 allows for future industrial use by removing the buildings and concrete and soils from selected areas of the Site. It places restrictions on future structures on the Site. Alternative 4 and Alternative 6 allow future industrial use, but the restrictions are more stringent than those of Alternative 7 because the buildings (cleaned) remain on the Site. Alternative 5 also allows future industrial use of the Site, but the available building area is significantly reduced by the large cap on the Site. Alternative 3 allows no future access or use of the Site, because this alternative leaves most of the materials containing PCBs on Site. Alternative 1 provides only minimal protection.

2. COMPLIANCE WITH ARARs

Potential chemical-, action-, and location-specific ARARs were reviewed. This review yielded the potential ARARs presented in Appendix B. All alternatives meet their respective ARARs except for Alternative 1. No location-specific ARARs were identified for the Site.

3. LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 8 provides long-term effectiveness and permanence by removing essentially all materials containing PCBs from the Site. Alternative 8 is the only alternative which allows unrestricted future access and use of the Site, because only minuscule amounts of PCB soils (<0.35 ppm) remain on the Site.

Alternative 7 provides long-term effectiveness and permanence by removing a large portion of the PCB materials from the Site. Some low level PCB soils (<10 ppm) remain on the Site. The land use restrictions used to control this risk are adequate and reliable if enforced.

Alternative 5 provides long-term effectiveness and permanence by controlling exposure to PCBs; removing the above ground structures; and capping soils, sediments, and exposed concrete slabs. The permanence of this alternative is dependent upon the maintenance of the cap.

Alternatives 4 and 6 allow future industrial use, but the restrictions are more stringent than those of Alternative 7 because more materials containing PCBs remain on the Site. There are also more uncertainties associated with the cleaning and encapsulation technologies used in Alternatives 4 and 6 to clean the buildings and concrete.

Alternative 6, which cleans the buildings but removes the concrete, allows future industrial use; however, restrictions again are more stringent than those of Alternative 7 because more PCB materials are left on Site. With Option B, only PCB soils with less than 10 ppm total PCBs are left on Site; with Option A, the PCBs soils (>10 ppm) are primarily capped (with selective removal of outlying PCB soils). Option B consequently has greater long-term effectiveness than Option A.

Alternative 4 is similar to Alternative 6 in that it has the same Options A and B and cleans the buildings but it also cleans and seals the concrete. Alternative 4 has restricted future industrial use. Alternative 4 has less long-term effectiveness than Alternative 6.

Alternative 3 allows no future access or use of the Site because this alternative (excepting Alternative 1) leaves the most materials (soils and buildings) containing PCBs on the Site.

All the alternatives except Alternative 8 will require five-year agency reviews.

4. <u>REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT</u>

All of the alternatives except for Alternative 1 provide some level of treatment. All of the alternatives treat surface water which is generated during sediment removal or which is from on-site ponds. The water is treated using activated carbon. The activated carbon reduces the volume of contaminated material and reduces the mobility of the PCBs. After the carbon is spent, it is regenerated and the PCBs are destroyed. Concern over PCB fate in regeneration may be of concern.

All of the alternatives also have the option of disposing of the removed soils and sediments by off-site landfilling or off-site incineration. If off-site incineration is chosen as a final disposal method, the reduction of PCBs by treatment is greatly increased. Incineration of soil and sediment in an EPA approved facility destroys over 99 percent of the PCBs. Incineration is irreversible, and the treatment residual, incinerator ash, must be landfilled. The volume of ash from incinerating soil, concrete, and building materials will be nearly 100 percent of the original volume, that is, there will be very little volume reduction from incineration.

There is also the concern of incinerator capacity. The amount of removed materials in these alternatives (excluding Alternatives 1 and 3) range from 3,023 to 141,954 tons. According to one incinerator facility, material could be accepted at a rate of 20 tons per month. This would require approximately 12 to almost 600 years to incinerate the removed materials. This is only an indication of the effect incinerator capacity could have on scheduling.

Landfilling of PCB materials does not meet the statutory preference for treatment. However, during the preliminary cleanup operation, approximately 491,000 pounds of PCBs (or 99.2 percent of all PCBs on-site when the RCSC took control of the Site) were destroyed by incineration. As has been shown in the detailed analysis of each alternative, all evaluated alternatives (except one) would involve off-site landfilling of PCBs in amounts of less than 1 percent of the PCB quantity already removed from the Site and destroyed by incineration. Therefore, although the landfilling by itself does not meet the statutory preference for treatment, all alternatives meet the statutory preference for treatment when both the preliminary removal operations and the response alternative are considered as a complete CERCLA response.

5. SHORT-TERM EFFECTIVENESS

The greatest short-term effectiveness is achieved by Alternative 1, since no response takes place. Among the alternatives that implement responses, Alternative 3 provides the next greatest short-term effectiveness since it involves the least amount of activities on-site which could cause dust or vapor emissions. The remaining alternatives have progessively higher short-term health risks associated with them because of their level of construction activities, and the length of time required to carry out the response action. The listing of alternatives in descending order of short-term effectiveness is 5, 4, 6, 7 and 8. However, during implementation of any of the alternatives, control measures could be instituted to mitigate short-term risks to an acceptable level.

No alternatives are expected to have a permanent adverse effect on the surrounding environment.

6. IMPLEMENTABILITY

The alternatives which use only conventional excavation and/or demolition technologies (Alternatives 3, 4-Option B, 6-Option B, 7 and 8) are less difficult to implement than those remaining alternatives which use a multi-media cap and/or cleaning/encapsulation technologies to remediate the Site. The multi-media cap requires more specialized equipment and personnel to construct than a soil cap. The multi-media cap may be damaged if a future response is required. The cleaning/ encapsulation technologies for the buildings and concrete also require specialized equipment and personnel. Their ability to perform effectively is uncertain.

Alternative 1 is the easiest alternative to implement in that it requires very little construction (fencing) and is unlikely to be delayed by technical problems. Future actions are likely to be necessary and would not be difficult to implement. Monitoring, although technically feasible, could be quite extensive to assess effectiveness.

If monitoring does not detect an actual failure, potential risk could be significant. Minimal coordination is necessary. Availability of personnel and equipment is not a problem.

Alternative 3 is also quite easy to implement in that it requires only conventional excavation technology for sediment removal. Future actions are likely to be required elsewhere on-site and would not be difficult to undertake.

Alternative 7 uses conventional excavation technologies to remove PCB sediments and soils and uses conventional demolition technologies to remove the buildings and concrete. There should not be any significant difficulties in implementing these activities. Upon completion, only minimal monitoring of the institutional controls would be required. Risk in case of monitoring failure would be low. Coordination between federal, state and local agencies should not be a problem. Permits for transportation and disposal of PCB materials should be obtainable. Personnel and equipment are readily available to complete this work. Availability of landfill capacity and acceptance of PCB materials by out-of-state landfills have not been problems but could be factors in the future. Concerning availability of incinerators, there may be a backlog of materials at the incinerators which could cause a considerable delay in implementation as discussed in the preceding section on treatment.

Alternative 8 is essentially the same as Alternative 7 except that substantially greater volumes of soil are removed from the Site. The other factors discussed for Alternative 7 apply to Alternative 8. However, with respect to removal and disposal, the concerns about incineration and landfills are greatly increased due to the sheer mass of materials being removed in Alternative 8.

Alternative 4B removes sediments and Site soils and cleans the buildings. The removal technologies are the same as discussed for Alternative 7. Option 4A caps the PCB soils (<10 ppm) with a multimedia cover. This has been used successfully before and its use here should not present any difficulties or cause any delays. The cleaning technologies used on the building are an iterative process; the number of iterations needed cannot be predicted with certainty. This could cause schedule delays. It may be necessary to further clean the buildings at a later date. The buildings would be readily accessible. Future monitoring does not present difficulties. Coordination with other agencies is necessary to implement this alternative. Permits for disposal of PCB materials are necessary. Personnel and equipment to remove the soils are readily available. Personnel and equipment for the cleaning process are less common but should still be available. Incineration and landfilling issues discussed under Alternative 7 also apply to this alternative.

Alternative 5 removes the sediments and buildings and caps the soils and concrete. The removal technologies are the same ones discussed for Alternative 7. The cap is the multimedia cover discussed in Alternative 4A. Future response actions would be more difficult due to the presence of the cover. Site monitoring should not present any difficulties. The work at the Site must be coordinated with the appropriate federal, state, and local agencies. Permits are needed for transportation and disposal of the PCB materials off-site. No significant difficulty is expected in obtaining them. The availability of personnel and equipment to implement this alternative is not a problem. Landfilling and incineration issues stated under Alternative 7 also apply to this alternative.

Alternative 6A is similar to Alternative 4A except that the concrete slabs in the buildings are removed. Because the concrete is removed from within the building, there are limitations on the size of equipment allowed in the building. This factor should not be a problem. The potential requirement to treat portions of the concrete slab, as discussed under Alternative 7, again is present. Once the slab is removed, sampling and removal of the interior subsurface soils is initiated. This is an iterative process and could cause schedule delays. Alternative 6B deals with the soils in the same manner (multi-media cover) as Alternative 4B.

7. <u>COST</u>

The costs are divided into two categories - Capital and O&M. The O&M cost is given as a present worth value of annual O&M costs using a 5 percent discount rate for a 30-year period. The costs are as of September, 1989. A summary of the costs is presented in Table IV-14 in ascending order of costs. As can be seen, each alternative (except for Alternative 1) has two disposal options - incineration and landfilling.

TABLE IV-14
SUMMARY OF COMPARATIVE ANALYSIS - COSTS
ROSE CHEMICALS SITE

ALTERNATIVE	DESCRIPTION	Capital Costs (1)		Present Worth Operation and Maintenance Cost (2)	Total Present Worth Cost	
		Off-site Landfilling	Off-site Incineration		Off-site Landfilling	Off-site Incineration
1	No Action (3)	$23,000		$49,000	$72,000	
3	Remove off-site PCB sediments; cap Site.	$3,200,000	$9,400,000	$160,000	$3,360,000	$9,560,000
5	Remove off- and on-site PCB sediments; cap Site and concrete; remove buildings.	$5,600,000	$14,400,000	$240,000	$5,840,000	$14,640,000
4 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings and concrete.	$6,800,000	$14,000,000	$150,000	$6,950,000	$14,150,000
6 (Option A)	Remove off- and on-site PCB sediments; cap Site; clean buildings, remove concrete.	$8,400,000	$22,800,000	$150,000	$8,550,000	$22,950,000
4 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings and concrete.	$9,000,000	$22,400,000	$50,000	$9,050,000	$22,450,000
7	Remove off- and on-site PCB sediments; removal of Site soils, buildings, and concrete.	$11,500,000	$37,200,000	$30,000	$11,530,000	$37,230,000
6 (Option B)	Remove off- and on-site PCB sediments; removal of Site soils; clean buildings, remove concrete.	$12,200,000	$36,800,000	$50,000	$12,250,000	$36,850,000
8	Complete removal of off- and on-site PCB sediments soils, concrete, buildings, and sewers.	$102,100,000	$359,400,000	$0	$102,100,000	$359,400,000

Notes: 1. Capital costs are rounded to nearest $100,000 (except Alternative 1).
2. Present Worth O&M costs are based on a 30-year term and a 5 percent discount rate and are rounded to the nearest $10,000 (except Alternative 1).
3. Alternative 1 does not include a landfill or an incineration option. However, the alternative cost is presented under the landfill disposal option column.

In general, incineration is about 4 to 5 times more expensive than landfilling. If portions of the concrete slab do require treatment prior to landfilling, Alternatives 1, 6, 7, and 8 all will be affected in the same way. The rankings with respect to cost would not change except for the possibility of Alternatives 4B and 6A exchanging places.

In general, the "capping" alternatives are less costly than the "removal" ones. As expected, it is less costly to secure materials in-place than to remove and dispose of them elsewhere. Table IV-15 is a breakdown of the quantities of materials assumed to be treated or removed for each alternative in the cost analysis. The alternatives are discussed in ascending order of costs (based on landfilling) in the subsequent paragraphs.

Alternative 1 - This is the least expensive alternative. Both capital and O&M costs are low although this alternative does not meet the requirement for protection of human health. If this alternative were acceptable, there is a high probability that future response actions at the Site would be necessary. Thus, this cost for Alternative 1 understates what the long-term actual cost is likely to be.

Alternative 3 - The buildings are fenced and the PCB soils on-site are primarily capped. With the buildings left untouched, the same concerns stated for Alternative 1 also apply to Alternative 3, in that it is likely future response actions would be required at the Site. The haul distance for clean capping material is a significant factor. If the haul distance increases, the cost of capping will increase.

TABLE IV-15
SUMMARY OF COMPARATIVE ANALYSIS - RESPONSE QUANTITIES
ROSE CHEMICALS SITE

MEDIUM	RESPONSE ACTION	UNITS	RESPONSE ALTERNATIVES								
			1	3	4A	4B	5	6A	6B	7	8
SEDIMENT	Remove all stream PCB sediments	tons	0	1,323	1,323	1,323	1,323	1,323	1,323	1,323	1,323
	Remove pond sediments >10 ppm PCBs (1)	tons	0	63	63	174	63	63	174	174	0
	Remove pond sediments >0.35 ppm PCBs	tons	0	0	0	0	0	0	0	0	4,807
	Cap pond sediments >10 ppm PCBs (2)	square feet	0	71,000	71,000	0	275,000	71,000	0	0	0
SURFACE WATER	Treat surface water from dewatered sediments	gallons	0	70,300	70,300	70,300	70,300	70,300	70,300	70,300	70,300
	Treat surface water from on-site ponds	gallons	0	545,000	545,000	545,000	545,000	545,000	545,000	545,000	545,000
SOIL	Remove site soils >10 ppm PCBs (1)	tons	0	1,912	1,912	5,150	2,298	1,912	7,481	7,481	0
	Remove site soils >0.35 ppm PCBs	tons	0	0	0	0	0	0	0	0	131,000
	Cap site soils >10 ppm PCBs (2)	square feet	0	71,000	71,000	0	275,000	71,000	0	0	0
BUILDINGS	Decontaminate buildings	tons	0	0	0	0	0	0	0	0	0
	Demolish and remove buildings	tons	0	0	0	0	558	0	0	558	558
CONCRETE SLABS	Decontaminate slabs (3)	tons	0	0	614	614	0	0	0	0	0
	Demolish and remove concrete slabs	tons	0	0	0	0	425	4,540	4,540	4,540	4,540
	Cap slabs	square feet	0	0	0	0	275,000	0	0	0	0
TOTALS	Sediments, soils, buildings, concrete removed	tons	0	3,298	3,912	7,261	4,667	7,838	13,518	14,076	142,228
	Surface water treated	gallons	0	615,300	615,300	615,300	615,300	615,300	615,300	615,300	615,300
	Soils and concrete capped	square feet	0	71,000	71,000	0	275,000	71,000	0	0	0

NOTES:
1. In alternatives which utilize capping, select soils and sediments which cannot be practically capped are removed.
2. Cap consists of a multi-layer RCRA type cap.
3. A portion of the concrete slab that cannot be decontaminated is assumed removed

Alternative 5 - This alternative removes the sediments and buildings and caps the PCB soils and concrete. One concern with capping involves the PCB material being left on-site. There is a possibility that having the PCB material on-site will not be acceptable in the future, and additional response actions will be required. Indefinite maintenance of the Site is required. The Site has a future industrial use but building area is limited because of the large cap.

Alternative 4A - The sediments are removed and the PCB soils are capped, but the buildings and concrete are cleaned. The concern with cleaning is that the number of iterations necessary to reach the low cleanup levels is unknown. Also, the depth of concrete removal is unknown. The concrete slab may have PCBs in varying concentrations throughout its depth. Consequently, if concrete cleaning is ultimately unachievable, the concrete may still have to be removed. The cost then would be greater than that of Alternative 6A which removes the slab without cleaning. Alternative 4A is more expensive than Alternative 5 which removes the buildings thereby providing more protection to the health and environment than Alternative 4A.

Alternative 6A - This alternative removes the sediments, caps the PCB soils, cleans the buildings, and removes the slab. The concerns about future remediation also apply to this alternative. This alternative is also more expensive than Alternative 5 (which removes the buildings) without providing greater advantage.

Alternative 4B - This alternative is the first "removal" alternative, i.e., the PCB soils are removed instead of capped. The buildings are cleaned. The concerns expressed under Alternative 4A about the iterative nature of cleaning and the ability to obtain a clean slab also apply here.

Alternative 7 - This alternative removes the sediments, buildings, concrete, and PCB soils (>10 ppm). This alternative places restrictions on future industrial buildings on the Site. The possibility of additional response actions being required is low.

Alternative 6B - This alternative removes the PCB sediments, PCB soils (>10 ppm), and concrete; the buildings are cleaned. This alternative is more expensive than Alternative 7 which not only removes the buildings but the concrete also.

Alternative 8 - Sediments, buildings, concrete, and PCB soils (>0.35 ppm) are removed. It provides unlimited future access and use. The possibility of additional response actions being required is practically zero. This alternative provides only marginally better protection than Alternative 7 but costs many times more than Alternative 7.

8. STATE ACCEPTANCE

To be addressed in the ROD.

9. COMMUNITY ACCEPTANCE

To be addressed in the ROD.

K. SUMMARY DISCUSSION

Alternatives 1 and 3 provide little protection to health and environment and are unlikely to be accepted by regulatory authorities. Consequently, they are eliminated.

The remaining alternatives have either a landfill or an incineration disposal option. The statutory preference for treatment can be achieved with either option because approximately 491,000 pounds of PCBs (greater than 99 percent of the total) already have been incinerated. In addition, incineration of the removed materials could significantly affect the project completion date because it could take years to incinerate the removed materials. Finally, because of the relatively low levels of PCBs in most of the materials remaining on-site, landfilling is an acceptable disposal method. Based on these factors, incineration is considered impractical and landfilling is the recommended disposal method.

The remaining alternatives all remove on- and off-site sediment. Their differences are primarily in approach to PCB soils. Therefore, these alternatives can be categorized into two groups - "capping" and "removal". Alternatives 4A, 5, and 6A cap the PCB soils while Alternatives 4B, 6B, 7, and 8 remove the PCB soils. Within each category, the differences between alternatives lie with the handling of buildings and concrete. The following paragraphs first review each category individually; then the most appropriate alternatives from each category are compared.

Of the capping alternatives, Alternative 5 (the least expensive) removes the buildings and caps the PCB soils and concrete. Future industrial use of the Site is allowed, but building area is restricted. This alternative provides good protection from exposure to PCBs and removes the buildings, which could be of concern in the future. Both Alternatives 4A and 6A clean and leave the buildings, but the probability of the buildings being used in the future is low for the following reasons:

- The buildings need, at a minimum, to be repaired and reinsulated before occupancy.

- The future occupant will have concerns about his liability in using a former hazardous waste disposal facility.

- There is nothing unique or special about the buildings or the Site that would make using them advantageous.

Consequently, Alternatives 4A and 6A do not provide any greater benefit for the higher cost. In addition, they have a potential for additional costs due to possible future building cleaning requirements or due to building removal for safety purposes if the buildings fall into disrepair. Therefore, Alternative 5 is the best capping alternative.

Of the removal alternatives, Alternative 7 is the second least expensive. It removes the buildings and concrete. Future industrial buildings on the Site must meet certain height and ventilation requirements. This alternative removes nearly all of the materials containing PCBs from the

Site thus providing good protection to health and environment. The least costly removal alternative, Alternative 4B, cleans and leaves the buildings in place. However, because of the unreliability of the concrete cleaning, removing the concrete may be necessary. If this occurs, then the cost of Alternative 4B will approach or exceed the cost of Alternative 6B. The cost of Alternative 6B is greater than that of Alternative 7. With either alternative 4B or 6B, the buildings are left in place. As discussed in the previous paragraph, this has no benefit and has a potential for greater future costs. Alternative 8 is about 10 times more costly than Alternative 7 without providing any substantial increase in benefits. While the potential for a future response being required after the implementation of Alternative 8 is practically zero, the potential for future actions after implementation of Alternative 7 is only slightly higher. Thus, of the removal alternatives, Alternative 7 is the best one.

The above analyses narrow the potential alternatives to 7 and 5. Both remove the off- and on-site sediment and the buildings. Alternative 5 caps the PCB soils and the concrete; Alternative 7 removes them. Both provide for future industrial use. Alternative 7 has building restrictions while Alternative 5 has only limited area for building. In essence, Alternative 5 secures the PCBs soils and concrete on-site, while Alternative 7 removes them to a specialized landfill. Both protect human health and provide long-term effectiveness and permanence. Alternative 5 has more long-term maintenance requirements; however, it creates low potential short-term health risks and costs 60 percent less than Alternative 7.

* * * * *

APPENDIX A

APPENDIX A

SUPPLEMENTAL PUBLIC HEALTH RISK ANALYSES

A. INTRODUCTION

ENVIRON Corporation was retained by Burns & McDonnell Engineering Company to assist in the evaluation of response alternatives for the Rose Chemicals site (Site). In particular, the following tasks were assigned to ENVIRON, the results of which are reported in this Appendix:

- Task 1 - Estimate the decrease in PCB volatile emissions from on-site soils over time, assuming that volatilization is the only attenuation process occurring.

- Task 2 - Evaluate the potential risks to an industrial worker via inhalation of PCB vapors within a new warehouse built at the Site.

- Task 3 - Assess the potential risks to an industrial worker that may result from volatilization from the PCB-containing Main Building slab. This exposure scenario assumes the building framework around the slab has been removed and a 5-foot RCRA cap is placed over the slab.

- Task 4 - Determine the acceptable PCB concentrations in the existing warehouse building walls considering the risks from inhalation exposures to a worker.

- Task 5 - Estimate the potential risks to humans associated with the ingestion of beef for a variety of exposure durations and sediment PCB concentrations. As shown in EA for the Site, the potential risk to humans from the ingestion of beef is primarily associated with the ingestion of PCB-containing sediments by cattle.

This analysis is not intended to be a rigorous risk assessment, but utilizes screening approaches with the overall objective of ensuring that the response actions being considered meet the FS criteria for long-term effectiveness. These criteria are contained in the main text of the FS, and only the relevant criteria are stated here. An "acceptable" exposure is assumed to conform to a less than 10^{-5} excess cancer risk for each typical exposure pathway. For noncarcinogenic effects, acceptable exposure is assumed to occur when the typical estimated chemical dose (MDD) does not exceed the reference dose (RfD) for any exposure pathway, i.e., the Hazard Index will not exceed one.

Several of the methodologies and models used in this report are described in the EA for the Site. Unless otherwise indicated, information about the Site and the other assumptions employed in the EA were utilized in performing the above tasks. Note that the analyses contained in this appendix do not take into consideration the reduction in average PCB concentrations that would occur at the Site if any soil cleanup were conducted, and are therefore conservative. Also, because the EA demonstrated that the risk at the Site was primarily contributed by PCB exposure, this assessment focuses on only PCB risks.

B. EFFECT OF TIME ON THE PCB EMISSION RATE

PCB emissions from contaminated soil were predicted in Appendix A of the EA for different exposure scenarios using an EPA model (EA, page A-2). The EA evaluated carcinogenic and noncarcinogenic risks for the on-site residential development scenario, considering PCB vapor infiltration into a hypothetical on-site residence and inhalation exposure to its occupants. Risks were assessed for the typical case by conservatively assuming exposures to be occurring under present site conditions. Because the EPA model predicts emissions from the Site to decrease with time, exposures to residents that may occupy the Site in the future, if the area was zoned residential, will be less than the exposures to a hypothetical current resident as predicted in the EA. Therefore, this analysis focuses on exposures to a hypothetical resident that may occupy the site in the future.

In order to estimate future emissions from the Site, the model described on Pg. A-2 of the EA was integrated with respect to time over the interval t_1 (initial time of occupancy) and t_2 (time of vacancy). Besides time, t, all the other parameters in equation 1 (EA, page A-2) remain essentially the same. The integration modifies the term $t^{-0.5}$ (equation 1) to $(t_2^{0.5}-t_1^{0.5})/(t_2-t_1)$. The modified equation was used to estimate PCB emissions at intervals in the future, as described below.

Carcinogenic risks were estimated in the EA for the on-site residential scenario over a 9-year exposure duration, assuming exposures to be occurring under present site conditions. The modified equation 1 was used to estimate PCB emissions in the future. Table A-1 presents the reduction in carcinogenic risks (corresponding to the decrease in PCB emissions) relative to the values presented in the EA, if residents were to occupy the Site for a 9-year period beginning 5, 10, or 15 years in the future. For example, the potential lifetime carcinogenic risk estimated in the EA for PCB vapor inhalation assuming current on-site residential exposure is 6.2×10^{-5}. This risk will be reduced by the factors contained in the last column of Table A-1 if residents occupied the Site in the future. Therefore, incorporating these factors the potential carcinogenic risks via vapor inhalation, if a resident began occupying the Site 5, 10, or 15 years in the future, are estimated to be 3.1×10^{-5}, 2.5×10^{-5}, and 2.1×10^{-5}, respectively.

TABLE A-1

REDUCTION IN CARCINOGENIC RISKS AT DIFFERENT TIMES

t_1(yrs)	t_2(yrs)	Reduction Factor
0	9	None (EA)
5	14	2
10	19	2.5
15	24	2.9

The EA estimated noncarcinogenic risks by considering PCB vapor exposures over a 7-day period, assuming present site conditions. The Hazard Index (MDD/RfD) from PCB vapor inhalation predicted in the EA for the hypothetical on-site resident is 14 (typical case). For exposures that occur in the future, i.e., for 7-day exposure durations in 5, 10, or 15 years in the future, the loss of PCBs over time will result in significantly lower PCB emission rates (and noncarcinogenic risks) than predicted in the EA. This reduction in exposures and consequent reduction in noncarcinogenic risks is listed in the last column in Table A-2. For example, the noncarcinogenic risks predicted for a 7-day exposure period if residences are built on-site in 5 years is 0.44, i.e. 14/32.

TABLE A-2

REDUCTION IN NON-CARCINOGENIC RISKS AT DIFFERENT TIMES

t_1 (yrs)	t_2	Reduction Factor
0	0 yrs & 7 days	None (EA)
5	5 yrs & 7 days	32
10	10 yrs & 7 days	46
15	15 yrs & 7 days	56

C. FUTURE USE OF THE SITE AS AN INDUSTRIAL AREA

Among the future uses contemplated for the Site is its use as an industrial area similar to its past use. This assumes that new warehouse-type metal buildings would be constructed at the Site. In this section, worker exposure is evaluated to determine whether PCB vapor inhalation by a worker within the warehouse results in acceptable risks (using the FS criteria for acceptability).

A screening analysis was performed by assessing the anticipated reduction in the potential risk from vapor inhalation estimated for the on-site resident scenario (EA), when industrial worker exposure assumptions are applied. This analysis focuses on carcinogenic risks, which are anticipated to be of greater concern than noncarcinogenic risks, because a significant reduction in short-term PCB emissions are expected by the time industrial development occurs at the Site as indicated in the preceding section. As shown in Table A-2, the MDD/RfD ratio of 14 predicted in the EA for indoor PCB vapor inhalation by a hypothetical on-site resident is anticipated to be a factor of 32 lower, if residences were built at the Site in 5 years. Industrial exposures will result in even lower noncarcinogenic risks, and would adequately meet the FS acceptability criteria for noncarcinogenic effects (MDD/RfD less than 1).

The potential carcinogenic risk predicted in the EA for vapor inhalation exposure to the hypothetical on-site resident is 6.2×10^{-5}. Tables 46 and 47 of the EA show the exposure assumptions used for industrial exposure and residential exposure, respectively. For exposure to the same concentrations of a chemical, residential exposure results in a factor of 1.75 times higher risks than industrial exposure due to differences in the exposure assumptions (EA, Table 46, 47). Therefore, typical industrial exposure to the indoor air concentration predicted in the EA would result in a potential risk of 3.5×10^{-5} ($6.2 \times 10^{-5}/1.75$).

A further reduction would result in an industrial setting since residences tend to be fairly tight, minimizing indoor-outdoor air circulation. As shown on page A-10 of the EA, equation 12, the air exchange rate and ceiling height are important variables in determining the concentration of a chemical indoors. A ceiling height of 20 feet for a warehouse results in a significantly greater volume of air for mixing than the 8-foot ceiling height typical of residences. Similarly, a metal warehouse would have a greater air exchange rate than the 0.5 air changes per hour (ach) assumed for a residence. Conservatively assuming a 1.0 ach ventilation rate for a warehouse along with the 20-foot ceiling height will reduce indoor air concentrations in a warehouse 5-fold in comparison with a residence. Therefore, for a large, moderately tight warehouse located at the Site the carcinogenic risk would be less than 7×10^{-6} (3.5×10^{-5} (from last paragraph)/5). It should be noted that this risk estimate is very conservative, and does not incorporate the further reduction in risk that is anticipated to occur as a result of the loss of PCBs in soil prior to industrial occupation (see Table A-1). Not done for residences!

D. EMISSIONS FROM A SLAB COVERED BY A 5-FOOT RCRA CAP

An alternative being considered as part of the FS is to remove the building framework, and cover the PCB-contaminated slab with a 5-foot RCRA-type cap. PCB volatilization from the slab and through the 5-foot cover could result in inhalation exposures to a worker at the Site. Emissions through the cover were assessed by assuming the cap consisted of only soil. This is very conservative because the presence of liners (synthetic and clay) in the cap provide a more efficient barrier to vapor emissions than soil. The Superfund Exposure Assessment Manual, U.S. EPA, 1988 (SEAM) provides a steady-state equation for estimating emissions through a cover. This equation assumes that there is sufficient mass of contaminant in the source (slab) so that the source will not be depleted over time. The equation was modified to take into consideration the moisture content of soil, and is presented below:

$$J = 0.01\ D\ (N_a^{10/3}/N_t^2)\ C_s\ X/d$$

where:

J = emission flux of PCBs, $g/m^2/s$

D = gas phase diffusivity of PCBs in air, cm^2/s

N_a = air porosity of soil cover, 0.24

N_t = total porosity of soil cover, 0.4

C_s = saturated vapor concentration of PCBs, g/m^3

X = mole fraction of PCBs in the slab

d = depth of soil cover, 152.4 cm

The physicochemical parameters for PCBs are presented in Table A-1 of the EA. A 10 percent moisture content was used to calculate the air porosity of 0.24. Mole fractions for each Aroclor were determined based on the average unbiased concentrations in the concrete slab. The mole fraction for Aroclor 1242 was calculated to be 0.33, and Aroclor 1254/1260 was 0.67. Using these parameter values the emission flux for PCBs was calculated to be 5×10^{-10} $g/m^2/s$. The concentration in air was estimated using the box model described in the EA (Appendix A, equation 10), with a wind speed of 4.8 m/s, and a dispersion factor of 0.03. The PCB concentration in air was estimated to be 3.5×10^{-3} ug/m^3.

Potential risks to an industrial worker at the Site inhaling 3.5×10^{-3} ug/m^3 PCBs were estimated using the procedures presented in the EA and the exposure assumptions contained in Table 46 of the EA for the future use scenario -industrial exposure. The estimated potential carcinogenic risk is 1.5×10^{-7}, and the MDD/RfD ratio is 0.0022. These risks are well below acceptable risks.

E. <u>DETERMINATION OF ACCEPTABLE PCB CONCENTRATION IN BUILDING WALLS</u>

The results of the EA showed that the concentration of PCBs in the walls of site warehouse buildings would have to be cleaned to a concentration of 4.1 ug/100 cm^2 to meet the FS criteria for acceptability. This target level was established from a consideration of dermal exposure to an industrial worker. In this section, an analysis of inhalation exposure to an industrial worker was conducted to ensure the dermal-derived target concentration would not result in unacceptable inhalation exposures.

Since equations were unavailable for estimating the PCB emissions from the walls, a screening analysis was performed to evaluate the potential risk to a worker if all the PCBs contained in the walls were released at a uniform rate during the typical 10-year occupational period for a worker. For purposes of this analysis it was assumed that measures would be taken to ensure the total amount of PCBs within the building walls will not exceed 4.1 ug/100 cm^2. This concentration refers to the total surficial and in-depth PCB concentration.

This scenario assumes the slab has been removed or otherwise treated so that indoor air PCBs can only be contributed by volatilization from the interior surfaces of the Main Building. The area of the interior surfaces of the Main Building is 185,000 ft^2 (1.72E+08 cm^2) (personal communication, Burns

& McDonnell). Given the target concentration of PCBs in the walls of 4.1 ug/100 cm^2, the maximum possible emission rate is the ratio of the total quantity of PCBs contained in the walls and the exposure duration for the worker (10 years).

Quantity of PCBs = 4.1 ug/100 cm^2 (10^{-3} mg/ug) (1.72E+08 cm^2) = 7047 mg

Therefore, the maximum PCB emission rate over the 10 year exposure period
= 7047 mg/(10 yr x 365 d/yr x 86400 s/d)
= 2.2 x 10^{-5} mg/s.

Using this maximum emission rate, the air concentration indoors is calculated using the procedure outlined in Appendix A of the EA, specifically page A-10, equation 12, and page A-14. Thus, the maximum average concentration of PCBs in the air within the Main Building over the 10-year period is 3.5 x 10^{-7} mg/m^3. This assumes that the relatively high air exchange rate of 4.3 ach, which applies to the building in its current state, continues to apply in the future.

Applying the exposure assumptions in Table 46 of the EA (future use scenario - industrial worker), the estimated potential carcinogenic risk corresponding to the calculated air concentration is 1.5 x 10^{-8}. For noncarcinogenic effects, the Hazard Index (RfD/MDD) was estimated to be 0.0002, assuming all the PCBs are uniformly released over the 10-year period. If the air exchange rate corresponded to a tight structure (1.0 ach), the risks from vapor inhalation would still be within the acceptable range.

Therefore, if the building walls were remediated to the target concentration of 4.1 ug/100 cm^2, potential inhalation risks to a worker from indoor inhalation of PCB vapors would be acceptable.

F. RISKS ASSOCIATED WITH THE INGESTION OF BEEF

Because the risk to humans from the ingestion of beef is primarily associated with the ingestion of PCB-containing sediments by cattle, the equation in Appendix C of the EA that estimates the concentration of PCBs in beef can be simplified to:

$$C_b = F\ (f_s\ Q_s\ C_s) f_c$$

where

C_b = estimated concentration of PCB in beef, mg/kg

F = biotransfer factor in beef, 0.15 d/kg

f_s = fraction of PCB in sediment that is absorbed by the animal, 1.0

Q_s = quantity of soil or sediment consumed by animal, 0.7 kg/d

C_s = concentration of PCB in sediment, mg/kg

f_c = fraction of intake obtained from contaminated sources, 0.1

For this analysis, sediment concentrations ranging from 1 to 25 mg/kg were used as inputs in calculating resulting concentrations in beef.

The risk to humans from the ingestion of beef is estimated using the following formula:

$$Risk = CPF\ C_b\ I_b\ AF_s\ ED_b/BW$$

where

CPF = Carcinogenic Potency Factor, 7.7 $(mg/kg/d)^{-1}$

C_b = Concentration of PCBs in beef, mg/kg

I_b = Ingestion rate of beef, 0.044 kg/d

AF_s = Absorption factor, 1

ED_b = Exposure duration, simplifies to the number of years exposed divided by the number of years per lifetime (75)

BW = Body weight, 78 kg

For this analysis, the number of years exposed ranged from 1 to 9 years.

Table A-3 presents the potential carcinogenic risk associated with the ingestion of beef as a function of PCB sediment concentration and exposure duration. As can be seen, the risks vary from 1.4×10^{-4} (sediment concentration of 25 mg/kg and exposure duration of 9 years) to 6.1×10^{-7} (sediment concentration of 1 mg/kg and exposure duration of 1 year). The calculations to arrive at the risk levels are linear. Therefore, the risks for any sediment concentration or exposure duration not presented in the table can be easily calculated.

TABLE A-3

LIFETIME CARCINOGENIC RISKS ASSOCIATED WITH THE INGESTION OF BEEF

Chemical	Concentration in Sediment (mg/kg)	Concentration in Beef (mg/kg)	Carcinogenic Risk Levels for Different Exposure Durations 1 year	2 years	5 years	9 years
PCB	1	1.1×10^{-2}	6.1×10^{-7}	1.2×10^{-6}	3.0×10^{-6}	5.5×10^{-6}
	2	2.1×10^{-2}	1.2×10^{-6}	2.4×10^{-6}	6.1×10^{-6}	1.1×10^{-5}
	5	5.3×10^{-2}	3.0×10^{-6}	6.1×10^{-6}	1.5×10^{-5}	2.7×10^{-5}
	10	1.1×10^{-1}	6.1×10^{-6}	1.2×10^{-5}	3.0×10^{-5}	5.5×10^{-5}
	20	2.1×10^{-1}	1.2×10^{-5}	2.4×10^{-5}	6.1×10^{-5}	1.1×10^{-4}
	25	2.6×10^{-1}	1.5×10^{-5}	3.0×10^{-5}	7.6×10^{-5}	1.4×10^{-4}
	23.4	2.5×10^{-1}	1.4×10^{-5}	2.9×10^{-5}	7.1×10^{-5}	1.3×10^{-4}

APPENDIX B

APPENDIX B

IDENTIFICATION OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS (ARARS)

A review of Federal, State, and local laws, regulations, and policies was performed to identify potential ARARs for the Site. Both chemical- and action-specific ARARs were identified. No location-specific ARARs were found to exist for the Site.

The standards included in the PCB Spill Cleanup Policy were reviewed for potential application as chemical-specific ARARS. These guidelines are not controlling at the Site because spills occurring before May 4, 1987 are specifically exempted. In addition, the PCB Spill Cleanup Policy is believed to be not generally relevant to the conditions present at the Site. The policy was established to regulate cleanup of a defined individual PCB spills soon after its occurrence. The conditions present at the Site are the result of undefined releases in undefined areas of the Site over a period of years. However, the science and health input into the numerical standards contained in the policy are independent of the conditions or means of PCB release. Therefore, the numerical cleanup standards contained in the PCB Spill Cleanup Policy are believed to be relevant and appropriate for establishing numerical exposure standards for response actions at the Site. This ARAR is shown in Table B-1.

Other potential chemical-specific ARARs based on state water quality standards are discussed in Part II. The discussion concludes that no water quality-based chemical-specific ARARs exist.

TABLE B-1
DOCUMENTATION OF POTENTIAL CHEMICAL-SPECIFIC ARARS
ROSE CHEMICALS SITE

POTENTIAL CHEMICAL-SPECIFIC ARARS	REMEDIAL ALTERNATIVES 1	3	4 (Option A)	4 (Option B)	5	6 (Option A)	6 (Option B)	7	8
EPA PCB SPILL CLEANUP POLICY 40 CFR 761 Sets exposure limits at 10 ppm in soil; 10 ug/100 sq.cm. for surfaces.	Does not meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.

Several potential action-specific ARARs based on RCRA, TSCA, and OSHA requirements were identified for the Site. These ARARs apply to all facets of the response activities described in the alternatives including:

- Site security
- Closure and post closure activities
- Container storage
- Tank storage
- Physical and chemical treatment
- Prohibition on land disposal
- Discharge and transport of water to POTW
- PCB storage and disposal
- Transport requirements for hazardous wastes
- Worker safety

The specific list of potential action-specific ARARs is given in Table B-2.

One potential location-specific ARAR was initially identified. The Fish and Wildlife Coordination Act requires actions to protect fish and wildlife sources when any natural stream is modified. However, sediment removal from East Pin Oak Creek and its unnamed tributary is expected to have little impact on aquatic life or wildlife because the streams support little aquatic life in their current conditions. This potential ARAR was subsequently rejected as not applicable nor relevant.

* * * * *

TABLE B-2
DOCUMENTATION OF POTENTIAL ACTION-SPECIFIC ARARS
ROSE CHEMICALS SITE

POTENTIAL ACTION-SPECIFIC ARARS	REMEDIAL ALTERNATIVES								
	1	3	4 (Option A)	4 (Option B)	5	6 (Option A)	6 (Option B)	7	8
SITE SECURITY 40 CFR 264.14	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Not an ARAR.	Not an ARAR.
CLEAN CLOSURE 40 CFR 264.111	Not an ARAR.	Not an ARAR.	Not an ARAR.	Not an ARAR.	Not an ARAR.	Not an ARAR.	Not an ARAR.	Not an ARAR.	Will meet.
CLOSURE WITH WASTE IN PLACE 40 CFR 264.228	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Not an ARAR.
POST CLOSURE CARE 40 CFR 264.310	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Not an ARAR.
CONTAINER STORAGE 40 CFR 262.34(a) (< 90 days) 40 CFR 264.171-175 (> 90 days)	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
TANK STORAGE 40 CFR 264.190-198	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
PHYSICAL AND CHEMICAL TREATMENT 40 CFR 265.400-406	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
PROHIBITION ON LAND DISPOSAL (1) 40 CFR 268.32	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
DISCHARGE AND TRANSPORT OF WATER TO POTW 40 CFR 270.60(c) and 403.5 Local POTW Regulations	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
PCB STORAGE AND DISPOSAL 40 CFR 761.40-45 and 761.60-79	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
TRANSPORT REQUIREMENTS FOR HAZARDOUS WASTES 49 CFR 107 and 171.7-172.558	Not an ARAR.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.
WORKER SAFETY 29 CFR 1910.120	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.	Will meet.

1. After November 8, 1990, soil or concrete must be treated to less than 1,000 mg/kg PCBs prior to landfilling.

APPENDIX C

APPENDIX C

CALCULATION OF MEDIA VOLUMES AND AREAS

A. GENERAL

The objective of this Appendix is to estimate volumes and areas of the different environmental media which may be affected by the response action objectives.

For media containing PCBs, the volumes or areas are estimated using (1) information developed during the RI, (2) guidelines derived from the PCB Spill Cleanup Policy, and (3) reasonable assumptions about extent of contamination. No response action objectives applicable to media containing VOCs have been identified.

B. CALCULATIONS

The locations of interest are presented on Figures II-1, II-2, and II-3. Estimated volumes and areas of various site media are presented in Tables II-5 and II-6, respectively. Assumptions used to prepare Tables II-5 and II-6 are discussed in the following sections.

1. EXTERIOR SUBSURFACE SOILS

Locations of interest are identified as follows:

- o Sanitary Sewers
  - Active Holden sanitary sewer
  - Abandoned Holden sanitary sewer
  - Abandoned Site connection to active Holden sanitary sewer

- o Storm Sewers
  - Active Site storm sewer system
  - Abandoned Site storm sewer system

a. Sanitary Sewers

(1) PCBs Exceeding 10 ppm: Concentrations of PCBs exceeding 700 ppm were detected in TP-1 at the junction of the abandoned Site sanitary sewer with the active Holden sanitary sewer. No PCB concentrations greater than 0.26 ppm were detected in the remaining test pits (TPs) along sanitary sewers. The PCBs detected in TP-1 are assumed to be the result of leakage at the junction of the sewers. Low concentrations of PCBs in the remaining TPs along sanitary sewers are assumed to indicate no significant leakage at these TP sites.

The minimum volume of soil with PCBs above 10 ppm at TP-1 is estimated to be 8 yd^3. This volume is based on an excavation depth of 5 feet, an excavation width of 4 feet, and an excavation length of 10 feet in the immediate vicinity of the junction. The maximum volume of soil along the site connection is estimated to be 148 yd^3 based on the entire length of 200 feet, a depth of 5 feet, and a width of 4 feet.

(2) PCBs Exceeding 0.35 ppm: With the exception of TP-1, no additional TPs along the sanitary sewer system exceed 0.35 ppm PCBs.

b. Storm Sewers

(1) PCBs Exceeding 10 ppm: PCB concentrations of 33 ppm (TP-3) and 46 ppm (TP-4) were detected in the storm sewer system extending from the manhole near the southwest corner of the Main Building to the unnamed tributary. Samples from TP-10 and TP-11, which are upgradient from the manhole, had no detectable PCBs.

PCBs in the subsurface soil along storm sewers are assumed to be the result of a chemical release(s) entering the manhole near the southwest corner of the Main Building. The subsurface soils along the storm sewer system upstream of the manhole are assumed to contain no PCBs.

The volume of subsurface soil with PCBs greater than 10 ppm along the storm sewers is estimated to be 334 yd^3. This figure is based on an excavation length of 375 feet (active and abandoned storm sewers), an average excavation depth of 6 feet, and an excavation width of 4 feet. The PCBs probably occur at or below the invert of the storm sewer system. However, volume calculations include the overlying soil because of the impracticality of segregating shallow soil from deep soil during the excavation process.

(2) PCBs Exceeding 0.35 ppm: With the exception of TP-3 and TP-4, no additional TPs along the storm sewer system exceed 0.35 ppm PCBs.

2. INTERIOR SUBSURFACE SOILS

a. Main Building

(1) PCBs Exceeding 10 ppm: Areas where PCB concentrations exceed 10 ppm are at the exterior loading dock area and at the trench (TT-1) in the southwest portion of the Main Building. The estimated volume of soil exceeding 10 ppm PCBs is 370 yd^3, assuming two 25 x 25 feet grids with a depth of 8 feet.

(2) PCBs Exceeding 0.35 ppm: The soil beneath the slab is assumed to exceed 0.35 ppm based on subsurface borehole data. For costing purposes, the soil beneath the slab is assumed to exceed 0.35 ppm to a depth of 12 feet because samples slightly exceeding 0.35 ppm are recovered from depths of up to 12 feet beneath the slab. Additional well data from boreholes outside the perimeter of the Main Building show PCB levels exceeding 0.35 ppm. A soil volume of 61,000 yd^3 is estimated for the area beneath and in the vicinity of the Main Building.

b. South Warehouse

No PCBs were detected below the South Warehouse.

3. SURFACE SOILS

a. PCBs Exceeding 10 ppm:

The largest areas of surface soils with PCB concentrations greater or equal to 10 ppm are located west of the Main Building and west of the South Warehouse. In addition, patches of soil exceeding

10 ppm appear to be scattered between the two buildings. The volume of soil is estimated to be 2,600 yd^3 based on a surface extent of 35,000 ft^2 and an excavation depth of 2 feet.

b. PCBs Exceed 0.35 ppm:

About 4.2 acres of the surface soil exceeds 0.35 ppm as indicated by surface sampling. Assuming an excavation depth of 2 feet, a volume of 13,500 ft^3 is estimated.

yds^3

4. SEDIMENTS

a. On-site Sediments

(1) Storm Water Retention Ponds: Sediment samples indicate PCB levels ranging between 0.8 to 2.7 ppm in these ponds. The ponds do not exceed 10 ppm PCBs, but do exceed 0.35 ppm PCBs. The volume of pond sediments estimated to exceed 0.35 ppm PCBs is 2,640 yd^3.

(2) Drainage Ditch: Samples from the drainage ditch indicate PCB levels ranging between 2.2 to 24.1 ppm. The volume of sediments in the drainage ditch is estimated to be approximately 34 yd^3. For excavation purposes the entire volume is treated as if the PCB concentration exceeds 10 ppm.

(3) Spill Containment Pond: Samples from the spill containment pond indicate PCB concentrations ranging from 23.9 ppm to 122 ppm.

The volume of sediments in the spill containment pond is approximately 60 yd^3, based on a 1-foot depth. The entire volume of soil is assumed to exceed 10 ppm PCBs for excavation purposes.

(4) On-site Portions of the Unnamed Tributary: Samples from the on-site portion of the unnamed tributary range from 0.3 ppm to 20.8 ppm PCBs. The total volume of sediment in the unnamed tributary is estimated to be 149 yd^3. The entire volume is assumed to exceed 1.8 ppm PCBs for purposes of excavation.

b. Off-site Sediments

(1) Unnamed Tributary: Samples from the off-site portions of the unnamed tributary do not exceed 10 ppm PCBs (max. 6.7 ppm). The total volume of sediments in the unnamed tributary off-site is estimated to be approximately 329 yd^3, based on a 1-foot depth. The entire volume is assumed to exceed 1.8 ppm PCBs for purposes of excavation.

(2) East Pin Oak Creek: Sediment samples from East Pin Oak Creek from the confluence with the unnamed tributary to 500 feet below the Holden WWTP outfall generally indicate concentrations of PCBs greater than 10 ppm. The estimated volume of sediments in East Pin Oak creek is approximately 348 yd^3, based on a 1-foot depth. The entire volume is assumed to exceed 1.8 ppm for excavation purposes.

5. BUILDINGS AND STRUCTURES

a. Main Building

(1) Floor Surface: The extent of PCB concentrations on the floor was estimated by assuming that the surface wipe in each grid area is representative of that grid area. Grids with two surface wipe samples were divided into two equal areas. The results are as follows:

CB Concentration	Approximate Area	Approximate Percent of Slab
$\geq$ 10μg/100cm^2	81,500 ft^2	87%
$\geq$ 100μg/100cm^2	70,300 ft^2	75%
$\geq$ 500μg/100cm^2	49,661 ft^2	53%
$\geq$ 1000μg/100cm^2	37,500 ft^2	40%
$\geq$ 2500μg/100cm^2	15,900 ft^2	17%

(2) Floor Concrete to 0.5-Inch Depth: Analyses of the upper 0.5 inch of concrete from 11 unbiased cores were performed. Areas and corresponding PCB concentrations were calculated by assuming the 11 unbiased cores are representative of the entire Main Building slab. The results of these calculations are shown below:

Concentration (ppm)	Percent of cores	Estimated Area (ft^2)
$\geq$ 10	91	85,200
$\geq$ 100	73	68,150
$\geq$ 500	55	51,100
$\geq$ 2500	18	17,000

Eleven biased cores were taken in areas of visible staining. The analytical results indicate that samples from the stained areas exhibit greater concentrations of PCBs than the unbiased samples. Visibly stained areas of concrete are assumed to be removed from the slab for costing purposes. It was estimated that 10 percent of the slab is visibly stained.

(3) Floor Concrete to 2-Inch Depth: Two cores were analyzed to a total depth of 2 inches. PCBs were detected over the entire depth of 2 inches in both cores. The data is insufficient to characterize the extent of PCBs present to 2.0 inches within the entire concrete slab.

(4) Floor Concrete to Total Depth: The total volume of concrete slab in the Main Building is 2,025 yd^3 ($\pm$ 4,100 tons). This calculation is based on a surface area of 93,700 ft^2 and an average concrete depth of 0.58 feet.

(5) Interior Walls: The walls of the Main Building are constructed of sheet metal, concrete, and brick. The estimated interior metal shell area is 26,000 ft^2. Sixteen unbiased interior wipe samples were obtained over this area and 5 (31%) detected PCB concentrations exceeding 10 ug/100cm^2. Two samples (13%) showed PCB concentrations exceeding 100 ug/100cm^2.

Seventeen unbiased wipe samples were taken on the concrete and brick interior wall surfaces. Seven samples (41%) exceeded 10 ug/100cm^2 total PCBs and 2 samples (12%) had total PCB concentrations greater than 100 ug/100cm^2.

(6) Interior Ceilings: The area of the ceilings is assumed to equal the area of the concrete slab (93,700 ft^2). Of the fifteen unbiased samples obtained, 6 (40%) detected PCBs at greater than 10 ug/100cm^2. No samples detected PCBs at greater than 100 ug/100cm^2.

(7) Interior Beams and Fixtures: PCB concentrations on horizontal beams and fixture surfaces were evaluated by horizontal wipe samples. Fifteen unbiased samples were obtained, and 80% showed greater than 10 ug/100cm^2 PCBs. Forty percent exceeded 100 ug/100cm^2 total PCBs. The total area of horizontal beams and fixtures was assumed to be 10 percent of the slab area, or 9,400 ft^2.

(8) Insulation: From destructive testing of insulation samples, an estimated average PCB concentration of 1,130 ppm was calculated. The minimum PCB concentration is approximately 46 ppm. The insulation is constructed of bulk fiberglass panels that are fit along walls and ceilings. It is estimated that 90% of the ceilings and 50% of the exterior walls are insulated. The average thickness is estimated at 0.29 feet. The total weight of insulation is 10 tons, assuming the insulation weighs 0.216 lbs/ft^2.

(9) Weight of Building Excluding Slab: The Main Building was visibly inspected to estimate the square footage of sheet metal,

the numbers and types of structural beams and columns, and the volume of concrete block walls. A weight of 510 tons is calculated from the estimated volume of building materials.

b. South Warehouse

(1) Floor Surface: PCBs concentrations range from 3.5 to 420 ug/$100cm^3$ and average 155 ug/$100cm^2$. The area of concrete slab is approximately 9,750 ft^2.

(2) Floor Concrete to 0.5-Inch Depth: The one unbiased core from the South Warehouse detected a total PCB concentration of 548 ppm.

(3) Floor Concrete to Total Depth: The estimated volume of the total slab is 210 yd^3. This estimate is based on an area of 9,750 ft^2 and a depth of 0.58 feet.

(4) Interior Walls: Surface wipe samples detected an average total PCB concentration of 31 ug/$100cm^3$. The estimated area of the building metal shell walls is 9,600 ft^2.

(5) Interior Ceilings: Surface wipe samples average approximately 30 ug/$100cm^3$ for the South Warehouse ceiling. The estimated ceiling area is 9,750 ft^2.

(6) Interior Beams and Fixtures: Analyses of five samples indicate that PCBs concentrations average $45\mu g/100cm^2$ on interior beams and fixtures. The surface area of beams and fixtures is assumed to be 10% of the slab or 980 ft^2.

(7) Insulation: One insulation sample taken from the South Warehouse indicates a concentration of approximately 60 ppm PCBs. The insulation is constructed of bulk fiberglass panels that are cut to fit along walls and ceilings. The average thickness is 0.29 ft. and the estimated area of insulation is 19,600 ft^2. Total weight of the insulation is 2 tons, assuming the insulation weighs 0.216 lbs/ft^2.

(8) Weight of Building Excluding Slab: The south warehouse was visibly inspected to estimate the square footage of sheet metal, the numbers and types of structural beams and columns, and the volume of concrete block walls. A weight of 34 tons is calculated from the estimated volumes of building materials.

6. SURFACE WATER

The estimated volume of water in each stormwater retention pond is approximately 162,000 gallons or a total of 485,000 gallons for the three ponds. The spill containment pond is estimated to contain approximately 60,600 gallons of water.

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APPENDIX D

APPENDIX D

EVALUATION OF TECHNOLOGY TYPES, AND OF PROCESS OPTIONS FOR SOILS, SEDIMENTS, BUILDINGS AND STRUCTURES, AND SURFACE WATERS

A. SOILS

1. NO ACTION

Approximately 90 percent of the surface soil at the Site does not exceed 10 ppm PCBs. No action is a feasible option for these areas based on the PCB Spill Cleanup Policy.

2. INSTITUTIONAL ACTIONS

The Site is fenced to prevent unauthorized access. A deed restriction restricts future use of the Site.

3. REMOVAL TECHNOLOGIES

Excavation is a well demonstrated technology that is feasible for some areas of the Site. For example, most treatment technologies use excavation in conjunction with the treatment process. Proper treatment or disposal of the excavated material can eliminate long term monitoring or maintenance.

Release of chemicals during excavation is a concern at any remediation site. Excavation technology includes various countermeasure procedures to minimize dust generation and dispersal.

4. TREATMENT

This section contains a preliminary evaluation of treatment technologies. Some screening data was obtained from the Technology Screening Guide for Treatment of CERCLA Soils and Sludges, U.S. EPA, September 1988. Additional information is from periodic U.S. EPA "Superfund Innovative Technology Evaluation" (SITE) newsletters and vendor-supplied information. In some cases the feasibility or nonfeasibility is contingent upon technology improvements made by vendors.

a. Vitrification (Electric Pyrolyzer)

This process employs an electric furnace to produce extremely high temperatures (3,000 degrees F) in order to destroy organics while producing a molten glass and metal by-product. The unit can effectively destroy PCBs in soils. However, the high temperature process is designed to treat wastes that contain toxic nonvolatile metals in addition to organics. The purpose of the high temperature is to encapsulate metals in a stable vitrified mass. Because there is no metal contamination at the Site, the extra step of vitrifying the waste appears unwarranted.

b. In-Situ Vitrification (ISV)

In the ISV process, four electrodes are inserted into the soil to the desired treatment depth. A conductive mixture of flaked graphite and glass grit is usually placed with the electrodes to act as the starter path for the electric circuit. Heat from the electric current passing through the electrodes and graphite produces a melt. As the melt grows downward and outward, it destroys organic chemicals such as PCBs and incorporates nonvolatile materials (metals) into the melt. A hood placed over the processing area collects evolved gases and transports gases to a treatment system.

ISV is judged not feasible for the Site soils. First, the PCBs at the Site are confined to relatively shallow depths. Materials at shallow depths are not effectively destroyed by the process without a cover of soil or other insulating material. Second, the technology has not been demonstrated during full-scale operations at an actual cleanup site. Uncertainty associated with full-scale treatment includes the type of waste by-products that may accumulate at the perimeter of the vitrified zone as a result of the process. Third, future liability may not be eliminated because the vitrified soil remains on-site. Long-term stability of the vitrified mass has not been field proven because ISV is a recent technology, thus post-treatment monitoring of the Site is a possible requirement.

c. Rotary Kiln Incineration

Rotary kiln incinerators are slightly inclined, refractory-lined cylinders that incinerate organic wastes such as PCBs under net oxidizing conditions. Wastes and auxiliary fuel are injected into the high end of the kiln and pass through the combustion zone as the kiln slowly rotates. Rotation of the chamber creates turbulence and improves the degree of solids burnout. Wastes are substantially oxidized to gases and inert ash. Flue gases are passed through a secondary combustion chamber and then through treatment units for particulate and acid gas removal.

The PCBs in soils are effectively destroyed by the rotary kiln process. Units are available for on-site or off-site incineration. TSCA permits generally allow on-site incineration of materials containing up 10,000 ppm PCBs. No soils from the Site appear to exceed 10,000 ppm PCBs. On-site disposal of the thermally treated soil must be approved by the U.S. EPA, if an on-site unit is used.

Off-site rotary kiln incineration is technically feasible for soils. However, it must be noted that it is difficult to implement off-site incineration given the large volumes of soil at the Site. During past remedial operations at the Site, landfilling of soils rather than incineration was demonstrated.

On-site rotary kiln incineration is not feasible for the Site because community acceptance is unlikely given to Site's location within the Holden city limits.

d. <u>Circulating Bed Combustor (CBC)</u>

The CBC is a special type of fluidized bed incinerator that uses a high air velocity in order to create a more turbulent combustion zone. Dry limestone, if added to the feed, reacts in the combustion zone to capture acid gases without the need for a scrubber treatment system. The entrained solids are separated from the flue gases by a cyclone and recycled to the combustor. The flue gases are cooled in a heat exchanger by the heating of water or combustion air. A baghouse filter removes any remaining particles from the gases.

A commercial unit is available for on-site incineration. The incinerator has a national operating EPA permit for incineration of materials with PCB concentrations up to 10,000 ppm. Some pretreatment of the soil is usually necessary because solid particle sizes are limited to less than is 1 inch. Debris such as rocks, roots, containers must be shredded for proper feed size. Disposal of the thermally treated soil by backfilling on site must be approved by the U.S. EPA. On-site inuneration is judged infeasible because local acceptance is unlikely.

e. Infrared Thermal Treatment (Shirco)

Infrared thermal units use silicon carbide elements to generate thermal radiation. Materials to be treated pass through the unit on a belt. Off-gases pass into a secondary chamber for further combustion and increased residence time. Flue gases are further treated with a scrubber unit.

A 100-ton per day commercial unit is available for on-site incineration. The incinerator has a national operating U.S. EPA permit for incineration of materials containing 15,000 ppm PCBs. Some pretreatment of the soil is usually necessary--the largest solid particle size is 1 to 2 inches. Debris such as rocks, roots, containers must be shredded for proper feed size. On-site disposal of thermally treated materials must be approved by the U.S. EPA if an on-site unit is used.

Infrared thermal treatment is judge not feasible for the Site because community acceptance is unlikely given the Site's location within the Holden city limits.

f. Low Temperature Thermal Stripping

This process involves contaminated soil moving through a pug mill or rotary drum system equipped with heat transfer surfaces. Organics are desorbed from the soil and are captured by an activated carbon filter or are destroyed in a combustion chamber. Thermal stripping systems are designed to treat soils containing organics with boiling points less than 800 degree F. A commercial system (X*TRAX™) is being tested by Chemical Waste Management on PCB contaminated soil.

Low temperature thermal stripping is judged not feasible for the Site because it has not been demonstrated at a full-scale cleanup operation. The residual amount of PCBs that remain in the treated soil is a potential problem, however, future improvements in the technology may render the process as effective as incineration.

g. Basic Extraction Sludge Treatment (B.E.S.T.)

In this process, the soil requires slurrying with water in order to be pumped through the treatment train. In addition, the pH of the slurry is raised to 10 by the addition of caustic soda. A solvent is mixed at cool temperatures with the slurried soil. At low temperatures the solvent is miscible with water. The solvent extracts organics such as PCBs from the soil particles. The slurried soil is centrifuged to separate the soil from the PCB-bearing liquid. The liquid is heated to separate the PCB-bearing solvent from the water. The solvent is decanted from the water and sent to a stripping tower where the solvent is separated from the PCB liquid. The solvent is recycled back into the treatment system. The PCBs require disposal, usually by incineration. The water effluent generally requires treatment by activated carbon prior to discharge.

The BEST process is judged not feasible for the Site. First, the process has not been demonstrated at a site where PCBs are the primary compound of interest. The process was demonstrated for a sludge at the General Refining Superfund site (Garden City, Georgia), where PCBs were present but not the primary compound of interest. In addition, the composition of the waste oil sludge treated at the General Refining site is different from soils at the Site, thus it is not possible to extrapolate results of this treatment to Site soils (low levels of PCBs and no hydrocarbon sludge component). Second, the BEST process does not result in the complete separation of PCBs from the soil matrix. If the soil is treated and backfilled at the Site, the residual levels of PCBs in the treated soil could be a potential concern in the future. Third, simple blending action of the treatment process could result in a low average level of PCBs in the soil without a significant mass transfer of PCBs to the treatment fluid. This is explained by noting the volume of soil which is excavated probably includes soil which may not contain detectable concentrations of PCBs (it is impractical to excavate the exact areas containing PCBs above 10 ppm. Invariably, surrounding soil is excavated during the process). It is possible that the average soil concentration after the first pass through the treatment train may meet treatment goals, yet the actual weight of PCBs removed by the treatment fluids may be significantly less than an option which completely removes soil from the Site. Fourth, the process results in a significant amount of waste effluents which must be treated and disposed of. Last, on-site disposal of the treated soil must be approved by the U.S. EPA.

h. Critical Fluid (CF) Solvent Extraction Technology

The process uses a liquefied gas such as CO_2, propane, or other light hydrocarbons as the extracting solvent. Such solvents have high solubilities for most listed hazardous organic compounds.

The unit operates in five basic steps. First, pumpable (slurried) solids are fed into the top of the extractor. Second, solvent is condensed by compression to near its critical point and allowed to flow upward through the slurry filled extractor. At this state the highly diffusive fluid dissolves and extracts organics from the soil. Third, the residual soil slurry is removed from the base of the extractor. Fourth, the mixture of solvents and organics leaves the top of the extractor and passes through a pressure reducing valve to a separator. The reduction of pressure causes the solvent to vaporize and flow out of the top of the separator. Fifth, the vapor is collected and recycled through the compressor as fresh solvent. The organics are left behind in the separator where they are drawn off from the bottom.

The extraction of PCBs from soils is demonstrated by pilot tests. A pilot scale system was tested on PCB-laden harbor sediments from the Massachusetts New Bedford Harbor Superfund Site during September 1988. Sediments containing 350 ppm PCBs were reduced to 10 ppm after 10 passes through the unit. Sediments containing 2,250 ppm PCBs were reduced to 96 ppm after six passes through the unit.

The CF technology is judged not feasible for the Site. First, the technology has not been demonstrated beyond the pilot scale for soils at a PCB cleanup site, thus the implementation problems associated with full-scale operations are of concern. Second, the soil requires slurrying which generates large volumes of wastewater that requires treatment and disposal at the end of the treatment process. Third, multiple passes of soil through the unit could escalate costs and increase the time frame of the remediation process. Fourth, simple blending action of the process may result in a low average level of PCBs without a significant mass transfer of PBCs ~~without a significant mass transfer of PCBs~~ to the treatment fluid. Sixth, the process generally does not result in the complete removal of PBCs from the soil matrix, therefore, residual levels of

PCBs in the treated soil could pose future concern if soil is backfilled at the Site. Last, backfilling of the treatment soil must be approved by the U.S. EPA.

i. Galson APEG Treatment

This process involves mixing of contaminated soil and alkaline polyethylene glycolate (APEG) solution to produce a slurry. The slurry is heated to 150 degrees F and mixed to promote reaction of the APEG with PCBs. The APEG reacts with the chlorine atoms on the biphenyl ring to produce glycol-biphenyls and KCl (potassium chloride). At the end of the process the soil is centrifuged and washed with several volumes of water. Reagent and wash waters are recycled.

The Galson APEG process is judged not feasible for the Site. First, the process is not commercially available at this time (the first full-scale unit is scheduled for testing at the Wide Beach, NY Superfund site in early 1990). Second, the treatment process does not completely destroy PCBs in soils as evidenced by residual levels of PCBs in treated soils during pilot testing. The residual levels of PCBs in the soil could pose a future concern if the soil is backfilled at the Site. Third, uncertainties exist with respect to full-scale implementation of the process at an actual PCB cleanup site. For example, reaction times of up to 5 hours were used to reduce the levels of PCBs in soil during pilot testing. Therefore, depending on the initial amounts of PCBs in the soil and the amount of dechlorination desired, the remedial process may be relatively slow. Fourth, backfilling of the treated soil at the Site must be approved by the U.S. EPA.

j. Hazcon

This process blends contaminated soil or sludge with cement, pozzolans, and a proprietary ingredient which reacts with organic chemicals. For PCBs the process uses aluminum hydroxide methyl ethyl glycol (ALMEG) for dehalogenation of PCBs. The soil is usually excavated and placed in concrete forms after mixing. The result is a concrete-like mass that contains the contaminants. The process has been field tested at the Douglasville Superfund site (Reading, PA) during October 1987. Results indicate that the volume of solidified soil was almost double that of the untreated feed.

The Hazcon process is judged not feasible for the Site. First, the large increase in volume of the treated soil would disrupt the original Site topography if the solidified blocks of soil are backfilled at the Site. Second, residual levels of PCBs in the treated soil could be a future concern. Third, the results of pilot testing at the Douglasville Superfund were inconclusive with regards to fixation of PCBs (the TCLP leachates of both the treated and untreated soil resulted in nondetectable PCB levels). Fourth, backfilling of the treated soil must be approved by the U.S. EPA.

k. Detoxifier™

Toxic Treatments of San Mateo, California, is testing an in situ method of removing VOCs from soil using steam or air. The two main components of the treatment equipment are the process tower and process train. The process tower contains two counter-rotating drills, each having a cutting blade 5 feet in diameter which is capable of operating to a depth of 27 feet. Each drill also contains two concentric pipes; the inner pipe is used to convey steam to the rotating cutting blades. Both steam and air serve as carriers to convey volatilized organics to the surface. A shroud collects the evolved gases. A treatment system condenses the steam and volatiles and then removes the organics through a distillation process.

The process tower has the capability of injecting chemicals that react with various chemicals such as PCBs. Stabilization by injection of pozzolanic agents is also possible.

The technology is not feasible for the Site. The process has not been used commercially for PCB contaminated soils. The only constructed unit is at a San Pedro, California, waste site. A demonstration of the technology during late Spring 1989 treated compounds other than PCBs.

l. Geo-Con Deep Soil Mixing

The system consists of a set of crane-supported leads which guide a series of mixing paddles and augers. As the ground is penetrated, stabilizing agents or other fluids are fed through the center of each shaft. The auger flights break the soil loose and lift it to the mixing paddles, which blend the additives with the soil. The augers are positioned to overlap each other to form a continuous block.

Large obstruction such as buried concrete blocks, boulders, or pilings, must be avoided. Rocks less than 1 foot in diameter can be mixed.

International Waste Technologies (IWT) used the Geo-Con system to treat soils contaminated with PCBs, VOCs and metals at Hialeah, Florida. The soil was drilled and blended with IWT's patented bonding agent. The IWT process bonds organic and inorganic compounds to create macromolecules which are resistant to acids and other deteriorating agents.

The Geo-Con process is judged not feasible for the Site. The process has been demonstrated by IWT for stabilizing PCBs; however, PCB residuals remain on site. Long-term stability of the treated soil has not been demonstrated. Long-term monitoring of the Site is a possible requirement.

m. Detox Industries System

The technology involves the adaptation of naturally occurring microorganisms to perform digestion of targeted organic wastes such as PCBs. The process has been pilot tested on PCB soils. It involves the slurrying of soil with water in an open-top tank. The tank is aerated and microorganisms, nutrients, and catalysts are added over time as needed. Reaction time is estimated at 2 to 4 months.

The Detox Industries system is not feasible for the Site because the treatment process is slow and wastewater effluent is produced. Energy requirements for the aeration tank would be significant. Residual levels of PCBs probably remain in the treated soil and could pose a future concern if soils are backfilled at the Site.

n. Biotrol Soils Treatment System

This technology is based on a series of physical separation and washing steps using water as a carrier for the soil. Contaminated soil is fed to a soil washing system, and the organics are transferred from the soil to the water phase. The technology is most effective on soils with a high proportion of sand (majority of particles greater than 200 mesh). The fine silts and clays are removed and not treated by the process. Particles greater than a 1-inch size are generally not treated by the process unless size reduction (shredding) is employed. The wastewater generated is usually treated by a biological fixed-film reactor and recycled back to the treatment system. The U.S. EPA indicates the process has potential for the treatment of PCBs in the future. A demonstration program at a former wood-preserving site is scheduled (no PCBs).

The process is not feasible for the Site because the technology has not been demonstrated for PCBs at a CERCLA site.

5. CONTAINMENT

a. On-site Chemical Landfill

The construction of a chemical landfill is a well demonstrated technology. A typical landfill consists of a compacted clay base underlying a set of liners that contain a leachate collection system. In addition, the surface of the landfill is capped with a synthetic liner followed by a soil cover. A monitoring well system is established for long term monitoring of the site. Construction of an on-site landfill requires an extensive permitting process. An on-site chemical landfill is not feasible due to the impracticality of permitting such a facility.

b. Off-Site TSCA Landfill

Transportation of materials to an off-site landfill is feasible. Use of an off-site landfill is a well demonstrated technology than can remediate the Site in a time span shorter than many on-site treatment technologies.

c. Capping

Capping of PCB contaminated soil is a feasible option at the Site. A soil layer or other capping material over existing areas of PCB contamination will significantly reduce the dermal and vapor inhalation pathways on the Site.

B. SEDIMENTS

1. NO ACTION

No action is not feasible for areas in the unnamed tributary and East Pin Oak Creek because PCB concentrations average more than 1.8 ppm. No action is feasible for on-site pond sediments which do not exceed 10 ppm PCBs.

2. INSTITUTIONAL ACTIONS

The Site is fenced to prevent unauthorized access. Access to Site ponds is currently prevented. No other types of access restriction are considered by the FS. It is not feasible to fence stream sediments located off-site in the unnamed tributary and East Pin Oak Creek.

3. REMOVAL TECHNOLOGIES

Most treatment and/or disposal technologies use excavation in conjunction with the treatment process. Proper treatment or disposal of the excavated material can eliminate long-term monitoring or maintenance of excavated materials.

Excavation is a well demonstrated technology that is feasible for areas of the Site, but not feasible for large areas of minor concentrations of compounds of interest. Sediments can be removed by conventional excavation equipment (backhoe) or by specialized equipment (Super-Sucker), or by washing into downstream collection basins using high pressure water.

Excavation technology includes various countermeasure procedures to minimize dust generation and sediment dispersal. Temporary sediment control structures, such as a temporary dike, may be necessary for the stream.

4. TREATMENT

Soil treatment technologies are applicable to sediments. A description of these technologies is previously presented and is not repeated here. Dewatering of sediments is a treatment process which is not discussed under soils and is added here. Dewatering of sediments is a method for reducing the weight and volume of material to be processed as well as meeting transportation requirements. Dewatering of sediments can be accomplished by a variety of mechanical devices such as various types of centrifuges, vacuum filters, and belt filters. Another potential method is to deposit the sediment on a suitable surface for drying. For sediment volumes of less than several hundred tons, it is generally more economical to add a pozzolanic material to stabilize sediment for transportation.

5. CONTAINMENT

Landfilling of dewatered sediment is equivalent to the landfilling of soil (i.e., containment of sediments in an off-site chemical landfill is feasible). Capping of off-site sediments is not feasible because future control of off-site areas such as East Pin Oak Creek and the unnamed tributary is uncertain. Capping of on-site sediments is feasible.

C. BUILDINGS AND STRUCTURES

Information on remedial technologies for buildings and structures has been obtained from Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites, U.S. EPA, March 1985. More recent technological developments are gathered from U.S. EPA SITE reports and vendor supplied information.

1. NO ACTION

No action is not feasible for the on-site buildings because of the health risks identified previously in the RI Report.

2. INSTITUTIONAL ACTIONS

The Site is fenced to prevent unauthorized access to Site buildings. Complete sealing of the structures is not indicated because neither volume nor toxicity of the waste at the Site is not reduced, and the integrity of the seal could be disrupted should a catastrophic event (i.e., severe weather) occur.

3. REMOVAL TECHNOLOGIES

Demolition refers to the complete destruction and removal of a building or structure. Dismantling is the selective removal of portions of a building or structure. Many treatment technologies use demolition or dismantling as a prerequisite to the treatment process. Proper treatment or disposal of the removed material can eliminate long term monitoring and maintenance. Removal technologies include various countermeasure procedures to minimize dust generation and dispersal.

4. TREATMENT

This section contains a preliminary evaluation of treatment technologies for buildings and structures. Some screening data were obtained from the Technology Screening Guide for Treatment of CERCLA Soils and Sludges, U.S. EPA, September 1988. Additional information is from periodic U.S. EPA SITE newsletters. In some cases the feasibility or infeasibility is contingent upon information that vendors have made available after publication of these documents. The first six technologies which follow have previously been discussed, therefore, only their applicability to buildings and structures will be addressed.

a. Vitrification (Electric Pyrolyzer)

Vitrification of concrete is technically possible by processing to a feed size of less than 4 inches. However, the technology is not feasible for the

Site because metals contamination is not a problem. The extra step of vitrifying the material is intended for encapsulation of metals.

b. In-Situ Vitrification (ISV)

In situ vitrification of the building materials such as concrete is not feasible. Building materials require processing to a granular material and burial to a treatment depth of several feet before the ISV process is technically possible. This procedure is impractical for the Site.

c. Rotary Kiln Incineration

Off-site rotary kiln incineration is feasible for nonmetallic building materials at the Site. On-site rotary kiln incineration is not feasible because local approval is unlikely given the location of the Site within the Holden city limits.

d. Circulating Bed Combustor (CBC)

The CBC is feasible for nonmetallic building materials at the Site. Materials such as concrete require shredding to a feed size of approximately 1 inch. On-site incineration introduces the problems of permitting and treated material disposal. On-site incineration is not feasible because local approval is unlikely given the location of the Site within the Holden city limits.

e. Infrared Thermal Treatment (Shirco)

The technology appears to be available only as a on-site technology, and on-site incineration introduces the problems of permitting and treated material disposal. On-site incineration is not feasible because local approval is unlikely given the location of the Site within the Holden city limits.

f. Low Temperature Thermal Stripping

The technology is not feasible for the Site because the unit has not been fully tested for PCB wastes.

g. Dusting/Vacuuming

Dusting and vacuuming are feasible in conjunction with other technologies. Surfaces are commonly cleaned by dusting or vacuuming prior to more intensive procedures such as solvent washing.

h. Grit Blasting

Grit blasting uses a high velocity stream of abrasives to clean surfaces. The process generates large volumes of dust and debris that require disposal. Grit blasting will not remove contaminants that have penetrated building materials such as concrete floors. The process is feasible for the surface decontamination of nonporous materials such as sheet metal and structural steel, and porous materials such as concrete block walls where PCBs have probably not penetrated.

i. Hydroblasting

This process uses hot or cold water combined with abrasives, solvents, or surfactants. The fluid is delivered at various pressures depending on the cleaning procedure. The process generates large volumes of contaminated liquids that require additional collection, treatment, or disposal. The process is ineffective for areas where PCBs have penetrated the surface. The process is feasible for the surface decontamination of nonporous materials such as sheet metal and structural steel.

j. Steam Cleaning

The process uses a portable steam generator to clean surfaces with PCBs. The process generates significant volumes of contaminated water which requires treatment and disposal. Steam cleaning is feasible for surface decontamination of nonporous materials such as sheet metal or structural steel. The equipment is readily available from vendors.

k. Photochemical Degradation

The process uses ultraviolet light (UV) to destroy PCBs on surfaces. Sunlight or artificial light sources can be used. Exposure of surfaces such as the slab to sunlight is a feasible option.

l. Scarification

The process uses special machinery to remove thin layers of concrete (0.25-inch) per pass. The process is effective for removing PCBs that have penetrated the slab to a shallow depth. Scarification to depths of several inches is possible, however, this is generally not economical for large areas. Scarification generates a watery paste bi-product which requires disposal. Scarification of selected areas of the Site is feasible.

m. Encapsulation

Encapsulation is the coating of a surface with a sealant to immobilize contaminants. Cleaning of some surfaces to a PCB level of less than 100 $ug/100cm^2$ and encapsulation is allowed by the PCB Spill Cleanup Policy. However, most surfaces must be cleaned to 10

$ug/100cm^2$. For surfaces that must be cleaned to 10 $ug/100cm^2$ encapsulation is deemed an option beyond the requirements of the PCB Spill Cleanup Policy.

Painting is a very simple form of encapsulation. However, painting is nondurable and offers little protection over time.

Encapsulating agents which penetrate porous surfaces such as concrete are available. An example is K-20 sealant. Wear resistance, long-term maintenance, and monitoring is a drawback of such encapsulants.

Encapsulation of cement with a thick coating of epoxy-based material is a more durable treatment. Surface preparation of concrete is required to insure a good bond with the epoxy, and maintenance is required should cracking occur. Encapsulation with epoxy or a similar material is a feasible technology providing long-term maintenance and monitoring is assured.

n. Solvent Washing

This process uses solvents to remove PCBs from surfaces. In some cases, the solvents are able to penetrate the surface and remove PCBs to a limited depth. Disadvantages include the potential for PCB-laden solvents to enter cracks in concrete and contaminate underlying soils. Solvents may also cause PCBs to migrate further into the concrete. In addition, solvents which are hazardous chemicals (i.e., chlorinated compounds) should not be used at the Site. Despite these drawbacks, solvent cleaning is a feasible technology for some areas of the concrete slab and steel surfaces.

"Envirosolv" is an example of a penetrating solvent. The vendor claims that after the solvent has penetrated the concrete, and set for several hours, a dried residue remains. The dried solvent is washed from the surface with water. The water is collected and treated by activated carbon. This solvent or a similar solvent is a potential technology for the Site.

"Rad Kleen" is an example of using FREON as a PCB solvent. The process is identified as a potential process for PCBs by the Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites, U.S. EPA, March, 1985. However, the process is designed for cleaning radioactive nuclides from surfaces and has not been demonstrated for PCBs.

5. CONTAINMENT

a. On-site Landfill

Construction of an on-site landfill requires extensive permitting. This option is judged not feasible for the Site.

b. Cap

Construction of a surface cap over the concrete slab is a potential option. A variety of cap designs and materials is available, and because excavation is not required, minimum disturbance of the Site results. The short-term health and environmental impacts normally associated with excavation are avoided.

The disadvantages of capping include: retention of a long-term, liability, no reduction in volume and toxicity of the waste, long-term monitoring and maintenance requirements, and the design life of a cap is unknown.

Capping of concrete slabs is a feasible option because the technology is well demonstrated and short-term risks associated with demolition of slabs are avoided.

c. Off-site TSCA Landfill

Transportation of materials to an off-site landfill is feasible. Use of an off-site landfill is a well demonstrated technology that can remediate the Site in a time span shorter than many on-site treatment technologies.

D. SURFACE WATER

1. NO ACTION

The source of PCBs in stream waters is probably from desorption of PCBs from sediment as well as suspension of PCB-bearing sediment. Cleanup of sediments in the unnamed tributary and East Pin Oak Creek should decrease the levels of PCBs detected in stream waters. Therefore, no action is a feasible alternative.

2. INSTITUTIONAL ACTIONS

The Site is currently fenced to prevent unauthorized contact with surface water in the ponds. It is not practical to fence off-site surface waters.

3. REMOVAL TECHNOLOGIES

Pumping of surface waters from on-site ponds is feasible. Pumping is required because the evaporation rate is insufficient to dewater the ponds. Due to the continuous nature of the off-site stream water, long-term pumping of off-site surface water is not feasible.

4. TREATMENT

Activated carbon is a proven method for removing PCBs from water, therefore, it is a feasible technology for use on surface waters collected in conjunction with other response actions at the Site.

5. DISCHARGE

After treatment, surface water may be discharged on-site or off-site. Treated water may be discharged on-site by either land application or direct discharge to the unnamed tributary. On-site discharges do not require permits or licenses, but substantive requirements of RCRA or NPDES permits must be followed.

Surface water may be discharged off-site by direct discharge to the POTW. Although the discharge may be made to a sewer on-site, the discharge is considered off-site by CERCLA. On-site discharges must satisfy both administrative and substantive requirements of the Clean Water Act, including both national and local pretreatment requirements.

6. <u>CONTAINMENT</u>

Long-term containment of the surface water in on-site ponds is not feasible because the Site is not located in a net evaporation climatological zone.

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APPENDIX E

APPENDIX E

ALTERNATIVE DEVELOPMENT

A. GENERAL

Part II identifies the compounds of interest (PCBs) at the Site and establishes the response action objectives on a medium-specific basis. The media requiring response action are given on the following table:

TABLE E-1
SUMMARY OF MEDIA REQUIRING ACTION TO MEET RESPONSE ACTION OBJECTIVES

Medium	Exposure Level* Controlled By	Affected Scenario	Pathway
1. Stream Sediments	Health	All	Beef Ingestion
2. Site Buildings (floors)	Health	No Action Industrial Dev.	Dermal Dermal
3. Site Buildings (walls)	Health	Industrial Dev.	Dermal
4. Site Buildings	Health	No Action Industrial Dev.	Inhalation
5. Site Soils	Health	Residential Dev.	Inhalation
6. Site Soils**	ARAR	No Action Industrial Dev.	NA

*Exposure levels may vary depending upon site use scenario.
**Includes on-site sediments.

Part II also identifies feasible technologies which can be used to address the various Site media and protect human health, welfare, and the environment from the unacceptable exposure levels. The degree of protection provided is dependent upon the technology selected (i.e., degree of protection varies among technologies).

Three scenarios for future Site use are considered - no action, industrial development, and residential development (unrestricted use). The allowable exposure level for each Site medium can vary depending upon the Site use scenario.

The response technologies are assembled on a medium-specific basis into site-wide response approaches (alternatives) which will provide overall protection of human health and welfare and the environment. As suggested by EPA Guidance, alternatives are developed to cover a range of response actions. At one end of this range is the no-action alternative where the Site is left primarily in its present state. The other end of the range leaves the Site with unrestricted future use. The development of this range of alternatives, starting with Alternative 1 as the no action alternative, is presented in the following paragraphs.

B. ALTERNATIVE 1

This alternative is the no action alternative and its future use is the no action scenario. The no action alternative proposes to protect human health, welfare, and the environment using the medium-specific technologies shown in the following table:

TABLE E-2

ALTERNATIVE 1 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off-Site Sediments	None
2. On-Site Sediments	Site Fencing
3. Site Buildings	Site Fencing
4. Site Soils	Site Fencing

This alternative allows no future use (for the foreseeable future) and access to the site is prohibited.

C. ALTERNATIVE 2

Alternative 2 is developed to provide an additional degree of protection above Alternative 1. Future use of the Site is the no action scenario. It is intended to protect the off-site resident from ingesting beef which has previously ingested PCB sediments from East Pin Oak Creek, or its unnamed tributary and to protect the on-site trespasser from the Site buildings. The technologies selected to provide the protection are shown in the following table:

TABLE E-3

ALTERNATIVE 2 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off-Site Sediments	Removal
2. On-Site Sediments	Site Fencing
3. Site Buildings	Site Fencing
4. Site Soils	Site Fencing

This alternative allows no future use (for the foreseeable future) and access to the site is prohibited.

D. ALTERNATIVE 3

Alternative 3 is developed to provide increased protection over that provided by Alternative 2. Future use is the no action scenario. This alternative includes the off-site sediment removal of Alternative 2 and adds on-site sediment removal, capping of the PCB soils (>10 ppm), and fencing of the Site buildings to protect the on-site trespasser. These technologies are summarized in the following table:

TABLE E-4

ALTERNATIVE 3 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Building Fencing
3. Site Soils	Capping

This alternative allows no future use (for the foreseeable future) and access to the Site is prohibited.

E. ALTERNATIVE 4

Alternative 4 is developed to allow the Site to be used in the industrial development scenario. This alternative includes off- and on-site sediment removal. The Site soils (PCBs>10 ppm) are either capped (Option A), as used in Alternative 3, or removed (Option B). The Site buildings are cleaned. These technologies are summarized in the following table:

TABLE E-5

ALTERNATIVE 4 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Cleaning
3. Site Soils	Capping (A) or Removal (B)

This alternative allows the Site and buildings to be used for light industry.

F. ALTERNATIVE 5

Alternative 5 is developed to allow the Site to be used in the industrial development scenario. Off- and on-site sediments are removed. Because of the concern with the iterative nature of cleaning technologies used in Alternative 4, this alternative removes the building skin and structure but leaves the concrete slab. The Site soils (PCBs>10 ppm) and concrete slabs are then capped. These technologies are summarized in the following table:

TABLE E-6

ALTERNATIVE 5 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	-
a. Building Skin & Structures	Removal
b. Concrete Slabs	Capping
3. Site Soils	Capping

This alternative allows the Site to be used for light industry.

G. ALTERNATIVE 6

Alternative 6 is developed to allow the Site to be used in the industrial development scenario. Off- and on-site sediments are removed. Because the concrete slabs are porous and may contain PCBs throughout their depths, this alternative removes the concrete slabs. The building skin and structures are cleaned. The Site soils (PCBs>10 ppm) are either capped (Option A) or removed (Option B). These technologies are summarized in the following table:

TABLE E-7

ALTERNATIVE 6 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	
a. Building Skin & Structures	Cleaned
b. Concrete Slabs	Removal
3. Site Soils	Capping (A) or Removal (B)

This alternative allows the Site to be used for light industry.

H. ALTERNATIVE 7

Alternative 7 is developed to allow the Site to be used in the industrial development scenario. Off- and on-site sediments are removed. Because of the unknown number of iterations in the cleaning process used in Alternatives 4 and 6 and because of the possible need to remove the buildings in the future (due to the buildings following into disrepair through non-use or due to lower PCB exposure levels), this alternative removes both the buildings and the concrete slabs. The Site soils (PCBs> 10 ppm) are removed. These technologies are summarized in the following table:

TABLE E-8

ALTERNATIVE 7 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediments	Removal
2. Site Buildings	Removal
3. Site Soils	Removal

This alternative allows the Site to be used for light industry.

I. ALTERNATIVE 8

Alternative 8 is developed to allow the Site to be used in the residential development scenario. This alternative removes the buildings and sediments. Due to the low cleanup level (PCBs>0.35 ppm), the removal of Site soils is much more extensive. The proposed technologies are summarized in the following table:

TABLE E-9

ALTERNATIVE 8 - PROPOSED TECHNOLOGIES

Medium	Proposed Technology
1. Off- and On-Site Sediment	Removal
2. Site Buildings	Removal
3. Site Soils	Removal

This Site is available for use as a residential area.

* * * * *

APPENDIX F

APPENDIX F - COST ESTIMATE

TABLE OF CONTENTS

ALTERNATIVE 1
NO ACTION

CONSTRUCT EXTENSION OF FENCE ALONG PROPERTY LINE SOUTH OF THE UNNAMED TRIBUTARY.(CHAIN LINK, 6GA W/ 3 STRANDS OF BARB. 725 FT @ $11.80/FT	CAPITAL	$8,555
2 CORNER POSTS @ 65.50	CAPITAL	$131
CLEARING OF BRUSH TO INSTALL FENCE(17.00/HR @ 10 HR.	CAPITAL	$170
SIGNS: METAL REFLECTIVE @ $9.00/S.F. @ 50' SPACING ALONG PERIMETER 3340' = 67 SIGNS	CAPITAL	$603
DEED RESTRICTION	CAPITAL	$8,500
CHECK AND MAINTAIN FENCES	ANNUAL O&M	$1,400
FIVE YEAR REVEIW	ANNUAL O&M	$1,800
	SUBTOTAL CAPITAL(W 25% CONTINGENCY)	$22,449
	TOTAL O&M	$3,200
	PRESENT WORTH O&M	$49,184
	TOTAL	$71,633

ALTERNATIVE 3
(REMOVE OFFSITE SEDIMENTS EXCEEDING 10 PPM PCBS)
CAP CONTIGUOUS AREAS OF SOIL, EXCAVATE NON-CAPPED SOIL EXCEEDING 10 PPM PCBS, LEAVE STRUCTURES
REMOVE ON SITE SEDIMENTS EXCEEDING 10 PPM PCBS WHERE CAP DOES NOT EXTEND

LAND FILLING(COST FOR LANDFILLING OF REMOVED MATERIALS)
COSTING FOR LANDFILLING OF ANY REMOVED MATERIALS

TOTAL REMOVAL OF SEDIMENT FROM EAST PIN OAK CREEK(600 FT)	CAPITAL	$931,026
AND OFFSITE PORTION OF UNNAMED TRIBUTARY	O&M	$0
INSTITUTIONAL CONTROLS, MAIN PERIMETER FENCING	CAPITAL	$22,500
	ANNUAL O&M	$1,400
FENCING OF BUILDINGS AND STRUCTURES	CAPITAL	$25,319
	ANNUAL O&M	$500
TOTAL REMOVAL OF SEDIMENT ON-SITE PORTION OF UNNAMED TRIBUTARY	CAPITAL	$231,828
	ANNUAL O&M	$0
FIVE YEAR REVEIW	ANNUAL O&M	$1,800
SPILL CONTAINMENT POND AND DITCH CLOSURE	CAPITAL	$78,433
(DEWATER POND ONLY, EXCAVATE DITCH)	ANNUAL O&M	$0
SURFACE CAPPING AND EXCAVATION	CAPITAL	$1,590,001
OF NON-CAPPED SOIL	ANNUAL O&M	$6,416
STORM WATER RENTION POND CLOSURE	CAPITAL	$291,317
	ANNUAL O&M	$0
TOTAL	CAPITAL	$3,170,424
	ANNUAL O&M	$10,116
	PW O&M	$155,483
	TOTAL	$3,325,907

INCINERATION
COSTING FOR INCINERATION OF ANY REMOVED MATERIALS

TOTAL REMOVAL OF SEDIMENT FROM EAST PIN OAK CREEK(600 FT)	CAPITAL	$3,154,583
AND OFFSITE PORTION OF UNNAMED TRIBUTARY	O&M	$0
INSTITUTIONAL CONTROLS, MAIN PERIMETER FENCING	CAPITAL	$22,500
	ANNUAL O&M	$1,400
FENCING OF BUILDINGS AND STRUCTURES	CAPITAL	$25,319
	ANNUAL O&M	$500
FIVE YEAR REVIEW	ANNUAL O&M	$1,800
TOTAL REMOVAL OF SEDIMENT ON-SITE PORTION OF UNNAMED TRIBUTARY	CAPITAL	$745,202
	ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	CAPITAL	$193,708
	ANNUAL O&M	$0
SURFACE CAPPING AND EXCAVATION	CAPITAL	$4,985,530
OF NON-CAPPED SOIL	ANNUAL O&M	$6,416
STORM WATER RENTION POND CLOSURE	CAPITAL	$291,317
	ANNUAL O&M	$0

TOTAL	CAPITAL	$9,418,159
	ANNUAL O&M	$10,116
	PW O&M	$159,125
	TOTAL	$9,577,284

ALTERNATIVE 4A: REMOVAL OF OFF-SITE(ALL) AND ON-SITE SEDIMENT(EXCEEDING 10 PPM PCBS)
CAPPING OF ONSITE SOILS, SEDIMENTS> 10 PPM, REMOVE OUTLIERS
DECONTAMINATION OF BUILDINGS
LANDFILLING OF SOILS AND SEDIMENT REMOVED FROM SITE

ALTERNATIVE 4B: REMOVAL OF OFF-SITE(ALL) AND ON-SITE SEDIMENT(EXCEEDING 10 PPM PCBS)
REMOVAL OF ON-SITE SURFACE AND SUBSURFACE SOILS EXCEEDING 10 PPM PCBS
DECONTAMINATION OF BUILDINGS
LANDFILLING OF SOILS AND SEDIMENT REMOVED FROM SITE

TOTAL				
TOTAL REMOVAL OF SEDIMENT FROM EAST PIN OAK CREEK(600 FT)			CAPITAL	$931,026
AND OFFSITE PORTION OF UNNAMED TRIBUTARY			ANNUAL O&M	$0
FIVE YEAR REVEIW			ANNUAL O&M	$1,800
INSTITUTIONAL CONTROLS, FENCING			CAPITAL	$22,500
			ANNUAL O&M	$1,400
TOTAL REMOVAL OF SEDIMENT ON-SITE PORTION OF UNNAMED TRIBUTARY			CAPITAL	$231,828
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION A		CAPITAL	$78,433
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION B		CAPITAL	$157,177
AND SEDIMENT REMOVAL			ANNUAL O&M	$0
SURFACE CAPPING AND	OPTION A		CAPITAL	$1,590,001
SURFACE SOIL NOT CAPPED			ANNUAL O&M	$6,416
STORM WATER RENTION POND CLOSURE			CAPITAL	$291,317
			ANNUAL O&M	$0
STRUCTURE DECON			CAPITAL	$3,605,773
			O&M	$0
REMOVAL OF SOILS >10 PPM PCBS	OPTION B		CAPITAL	$3,714,195
			O&M	0
TOTAL	OPTION A	CAPPING	CAPITAL	$6,750,878
			ANNUAL O&M	$9,616
			PV O&M	$147,798
			TOTAL	$6,898,676
	OPTION B	REMOVAL	CAPITAL	$8,953,816
			ANNUAL O&M	$3,200
			PV O&M	$49,184
			TOTAL	$9,003,000

ALTERNATIVE 4A: REMOVAL OF OFF-SITE(ALL) AND ON-SITE SEDIMENT(EXCEEDING 10 PPM PCBS)
CAPPING OF ONSITE SOILS, SEDIMENTS> 10 PPM, REMOVE OUTLIERS
DECONTAMINATION OF BUILDINGS AND SLABS
INCINERATION OF MATERIALS REMOVED FROM SITE

ALTERNATIVE 4B: REMOVAL OF OFF-SITE(ALL) AND ON-SITE SEDIMENT(EXCEEDING 10 PPM PCBS)
REMOVAL OF ON-SITE SURFACE AND SUBSURFACE SOILS EXCEEDING 10 PPM PCBS
DECONTAMINATION OF BUILDINGS AND STRUCTURES
INCINERATION OF MATERIALS REMOVED FROM SITE

TOTAL				
TOTAL REMOVAL OF SEDIMENT FROM EAST PIN OAK CREEK(600 FT)			CAPITAL	$3,154,583
AND OFFSITE PORTION OF UNNAMED TRIBUTARY			O&M	$0
FIVE YEAR REVEIW				$1,800
INSTITUTIONAL CONTROLS, FENCING			CAPITAL	$22,500
			ANNUAL O&M	$1,400
TOTAL REMOVAL OF SEDIMENT ON-SITE PORTION OF UNNAMED TRIBUTARY			CAPITAL	$745,202
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION A		CAPITAL	$193,708
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION B		CAPITAL	$468,340
AND SEDIMENT REMOVAL			ANNUAL O&M	$0
SURFACE CAPPING AND	OPTION A		CAPITAL	$4,985,530
SURFACE SOIL NOT CAPPED			ANNUAL O&M	$6,416
STORM WATER RENTION POND CLOSURE			CAPITAL	$193,708
			ANNUAL O&M	$0
STRUCTURE DECON			CAPITAL	$4,737,889
			O&M	$0
REMOVAL OF SOILS >10 PPM PCBS	OPTION B		CAPITAL	$13,036,075
			O&M	0
TOTAL	OPTION A	CAPPING	CAPITAL	$14,033,120
			ANNUAL O&M	$9,616
			PW O&M	$147,798
			TOTAL	$14,190,534
	OPTION B	REMOVAL	CAPITAL	$22,358,297
			ANNUAL O&M	$3,200
			PW O&M	$49,184
			TOTAL	$22,410,681

ALTERNATIVE 5: CAPPING ON-SITE AND SUBSURFACE SOILS EXCEEDING 10 PPM PCBS, REMOVAL OF SOILS
NOT CAPPED, REMOVAL OF STRUCTURE, LEAVE SLAB
LANDFILLING OF MATERIALS REMOVED FROM SITE

INSTITUTIONAL CONTROLS, FENCING	CAPITAL	$22,500
	ANNUAL O&M	$1,400
FIVE YEAR SITE REVEIW	ANNUAL O&M	$1,800
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT) AND OFFSITE PORTION OF THE UNNAMED TRIBUTARY	CAPITAL	$931,026
	O&M	$0
REMOVE SED. FROMUN-NAMED TRIBUTARY ON-SITE(300FT)	CAPITAL	$231,828
	O&M	$0
SPILL CONTAINMENT POND, DITCH	CAPITAL	$78,433
	O&M	$0
SURFACE CAPPING AND	CAPITAL	$2,976,406
SURFACE SOIL NOT CAPPED	ANNUAL O&M	$12,687
DEMOLITION LEAVE SLAB	CAPITAL	$1,053,152
	O&M	$0
STORM WATER RENTION POND CLOSURE	CAPITAL	$291,317
	ANNUAL O&M	$0
TOTAL	CAPITAL	$5,584,662
	ANNUAL O&M	$15,887
	PW O&M	$244,183
	TOTAL	$5,828,845

ALTERNATIVE 5: CAPPING ON-SITE AND SUBSURFACE SOILS EXCEEDING 10 PPM PCBS, REMOVAL OF SOILS NOT CAPPED, REMOVAL OF STRUCTURE, LEAVE SLAB INCINERATION OF MATERIALS REMOVED FROM SITE

INSTITUTIONAL CONTROLS, FENCING	CAPITAL	$22,500
	ANNUAL O&M	$1,400
FIVE YEAR REVEIW	ANNUAL O&M	$1,800
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT) AND OFF-SITE	CAPITAL	$3,154,583
PORTION OF THE UNNAMED TRIBUTARY	O&M	$0
REMOVE SED. FROM UN-NAMED TRIBUTARY ON-SITE(300FT)	CAPITAL	$745,202
	O&M	$0
SPILL CONTAINMENT POND, DITCH	CAPITAL	$193,708
	O&M	$0
SURFACE CAPPING AND	CAPITAL	$7,913,426
SURFACE SOIL NOT CAPPED	ANNUAL O&M	$12,687
DEMOLITION LEAVE SLAB	CAPITAL	$2,061,701
	O&M	$0
STORM WATER RENTION POND CLOSURE	CAPITAL	$291,317
	ANNUAL O&M	$0
TOTAL	CAPITAL	$14,382,437
	ANNUAL O&M	$15,887
	PW O&M	$249,903
	TOTAL	$14,632,340

ALTERNATIVE 6A:CAP SOIL >10 PPM PCBS, REMOVE OUTLIERS VERE CAPPING INFEASIBLE
REMOVE OFF-SITE SEDIMENTS EXCEEDING 10 PPM PCBS
CLEAN STRUCTURE , AND REMOVE SLAB
REMOVE SOIL EXCEEDING 10 PPM FROM BENEATH THE SLAB
ALTERNATIVE 6B: REMOVE OFF-SITE AND ON-SITE SEDIMENTS EXCEEDING 10 PPM PCBS
REMOVE ON-SITE SURFACE AND SUBSURFACE SOILS, CLEAN STRUCTURE , AND REMOVE SLAB
REMOVE SOIL EXCEEDING 10 PPM FROM BENEATH THE SLAB

INSTITUTIONAL CONTROLS, FENCING			CAPITAL	$22,500
			ANNUAL O&M	$1,400
FIVE YEAR REVEIV			ANNUAL O&M	$1,800
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT)			CAPITAL	$931,026
AND OFFSITE UNNAMED TRIB.			O&M	$0
UN-NAMED TRIBUTARY ON-SITE(300FT)			CAPITAL	$231,828
			O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION A		CAPITAL	$78,433
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION B		CAPITAL	$157,177
AND SEDIMENT REMOVAL			ANNUAL O&M	$0
DECONTAMINATION OF STRUCTURES			CAPITAL	$5,208,943
/REMOVE SLAB			O&M	$0
SURFACE CAPPING AND	OPTION A		CAPITAL	$1,590,001
SURFACE SOIL NOT CAPPED			ANNUAL O&M	$6,416
SURFACE/ SUBSURFACE SOIL >10 PPM	OPTION B		CAPITAL	$5,392,282
			O&M	$0
STORM WATER RENTION POND CLOSURE			CAPITAL	$291,317
			ANNUAL O&M	$0
TOTAL	OPTION A	CAPPING	CAPITAL	$8,354,048
			ANNUAL O&M	$9,616
			PV O&M	$147,798
			TOTAL	$8,501,846
	OPTION B	REMOVAL	CAPITAL	$12,235,073
			ANNUAL O&M	$3,200
			PV O&M	$49,184
			TOTAL	$12,284,257

ALTERNATIVE 6A: CAP SOIL >10 PPM PCBS, REMOVE OUTLIERS WERE CAPPING INFEASIBLE
REMOVE OFF-SITE SEDIMENTS EXCEEDING 10 PPM PCBS
CLEAN STRUCTURE, AND REMOVE SLAB
REMOVE SOIL EXCEEDING 10 PPM FROM BENEATH THE SLAB

ALTERNATIVE 6B: REMOVE OFF-SITE AND ON-SITE SEDIMENTS EXCEEDING 10 PPM PCBS
REMOVE ON-SITE SURFACE AND SUBSURFACE SOILS, CLEAN STRUCTURE, AND REMOVE SLAB
REMOVE SOIL EXCEEDING 10 PPM FROM BENEATH THE SLAB

INSTITUTIONAL CONTROLS, FENCING			CAPITAL	$22,500
			ANNUAL O&M	$1,400
FIVE YEAR REVIEW			ANNUAL O&M	$1,800
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT)			CAPITAL	$3,154,583
AND OFFSITE UNNAMED TRIB.			O&M	$0
UN-NAMED TRIBUTARY ON-SITE(300FT)			CAPITAL	$745,202
			O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION A		CAPITAL	$193,708
			ANNUAL O&M	$0
SPILL CONTAINMENT POND CLOSURE	OPTION B		CAPITAL	$468,340
AND SEDIMENT REMOVAL			ANNUAL O&M	$0
DECONTAMINATION OF STRUCTURES			CAPITAL	$13,381,093
/REMOVE SLAB			O&M	$0
SURFACE CAPPING AND	OPTION A		CAPITAL	$4,985,530
SURFACE SOIL OUTLIERS			ANNUAL O&M	$6,416
SURFACE/ SUBSURFACE SOIL >10 PPM	OPTION B		CAPITAL	$18,772,590
			O&M	$0
STORM WATER RENTION POND CLOSURE			CAPITAL	$291,317
			ANNUAL O&M	$0
TOTAL	OPTION A	CAPPING	CAPITAL	$22,773,933
			ANNUAL O&M	$9,616
			PW O&M	$147,798
			TOTAL	$22,921,731
	OPTION B	REMOVAL	CAPITAL	$36,835,625
			ANNUAL O&M	$3,200
			PW O&M	$49,184
			TOTAL	$36,884,809

ALTERNATIVE 7: REMOVAL OF SURFACE AND SUBSURFACE SOILS EXCEEDING 10PPM PCBS.
REMOVAL OF STREAM SEDIMENTS
REMOVAL OF POND SEDIMENTS EXCEEDING 10 PPM PCBS
DEMOLITION AND REMOVAL OF BUILDINGS AND STRUCTURES

INSTITUTIONAL CONTROLS, FENCING	CAPITAL	$22,500
	ANNUAL O&M	$1,400
FIVE YEAR REVEIW	ANNUAL O&M	$1,800
INSTITUTIONAL CONTROLS, FENCING	CAPITAL	$0
(NO EXPANSION OF FENCE ANTICIPATED)	ANNUAL O&M	$0
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT)	CAPITAL	$931,026
AND OFFSITE UNNAMED TRIB.	ANNUAL O&M	$0
REMOVE SEDIMENT FROM UN-NAMED TRIBUTARY ON-SITE(300FT)	CAPITAL	$231,828
	ANNUAL O&M	$0
REMOVE SEDIMENT FROM SPILL	CAPITAL	$157,177
CONTAINMENT POND, DITCH EXCEEDING 10 PPM PCBS	ANNUAL O&M	$0
REMOVE ONSITE SURFACE SOIL	CAPITAL	$5,392,382
EXCEEDING 10 PPMPCBS	ANNUAL O&M	0
STORM WATER RETENTION POND DEMOLITION	CAPITAL	$291,317
	ANNUAL O&M	$0
DEMOLITION AND REMOVAL OF STRUCTURES	CAPITAL	$4,522,023
	ANNUAL O&M	$0

CAPITAL	$11,525,753
ANNUAL O&M	$1,800
P W O&M	$27,666
TOTAL	$11,553,419

ALTERNATIVE 7: REMOVAL OF SURFACE AND SUBSURFACE SOILS EXCEEDING 10PPM PCBS.
REMOVAL OF STREAM SEDIMENTS
REMOVAL OF POND SEDIMENTS EXCEEDING 10 PPM PCBS
DEMOLITION AND REMOVAL OF BUILDINGS AND STRUCTURES

INCINERATION OF MATERIALS REMOVED FROM SITE

INSTITUTIONAL CONTROLS, FENCING	CAPITAL	$22,500
(NO EXPANSION OF FENCE ANTICIPATED)	ANNUAL O&M	$1,400
FIVE YEAR REVEIW	ANNUAL O&M	$1,800
REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600FT)	CAPITAL	$3,154,583
AND OFFSITE UNNAMED TRIB.	ANNUAL O&M	$0
REMOVE SEDIMENT FROM UN-NAMED TRIBUTARY ON-SITE(300FT)	CAPITAL	$745,202
	ANNUAL O&M	$0
REMOVE SEDIMENT FROM SPILL	CAPITAL	$468,340
CONTAINMENT POND, DITCH EXCEEDING 10 PPM PCBS	ANNUAL O&M	$0
REMOVE ONSITE SURFACE SOIL	CAPITAL	$18,772,590
EXCEEDING 10 PPMPCBS	ANNUAL O&M	0
STORM WATER RETENTION POND DEMOLITION	CAPITAL	$291,317
	ANNUAL O&M	$0
DEMOLITION AND REMOVAL OF STRUCTURES	CAPITAL	$13,750,190
	ANNUAL O&M	$0
	CAPITAL	$37,204,722
	ANNUAL O&M	$1,800
	P W O&M	$27,666
	TOTAL	$37,232,388

ALTERNATIVE 8: REMOVAL OF ON-SITE SURFACE AND SUBSURFACE SOILS AND ALL SEDIMENTS EXCEEDING 0.35 PPM PCBS. DEMOLITION AND REMOVAL OF STRUCTURES
LANDFILLING OF MATERIALS REMOVED FROM THE SITE

REMOVE SEDIMENT FROM E. PIN OAK CRK. EXCEEDING EXCEEDING 0.35 PPM PCBS	CAPITAL	$931,026
AND OFF-SITE UN-NAMED TRIBUTARY	O&M	$0
UN-NAMED TRIBUTARY ON-SITE(300 FEET)	CAPITAL	$231,828
	O&M	$0
REMOVAL OF SEDIMENT FROM SPILL CONTAINMENT POND,	CAPITAL	$157,177
DITCH EXCEEDING 0.35 PPM PCBS	O&M	$0
REMOVAL OF ONSITE SURFACE SOIL EXCEEDING 0.35 PPM PCBS	CAPITAL	$92,677,429
AND SUBSURFACE SOIL EXCEEDING 0.35 PPM PCBS	O&M	0
DEMOLITION AND REMOVAL OF STRUCTURES	CAPITAL	$4,522,923
	ANNUAL O&M	$0
STORM WATER RETENTION POND CLOSURE	CAPITAL	$3,573,539
REMOVAL OF SEDIMENT≥ 0.35 PPM	ANNUAL O&M	$0
TOTAL	CAPITAL	$102,093,922
	ANNUAL O&M	$0
	PRESENT WOR	$0
	TOTAL	$102,093,922

ALTERNATIVE 8: REMOVAL OF ON-SITE SURFACE AND SUBSURFACE SOILS AND ALL SEDIMENTS EXCEEDING 0.35 PPM PCBS. DEMOLITION AND REMOVAL OF STRUCTURES
INCINERATION OF MATERIALS REMOVED FROM SITE

REMOVE SEDIMENT FROM E. PIN OAK CRK. EXCEEDING EXCEEDING 0.35 PPM PCBS	CAPITAL	$3,154,583
UN-NAMED TRIBUTARY	O&M	$0
UN-NAMED TRIBUTARY ON-SITE(300 FEET)	CAPITAL	$745,202
	O&M	$0
REMOVAL OF SEDIMENT FROM SPILL CONTAINMENT POND,	CAPITAL	$468,340
DITCH EXCEEDING 0.35 PPM PCBS	O&M	$0
REMOVAL OF ONSITE SURFACE SOIL EXCEEDING 0.35 PPM PCBS	CAPITAL	$329,346,287
AND SUBSURFACE SOIL EXCEEDING 0.35 PPM PCBS	O&M	0
DEMOLITION AND REMOVAL OF STRUCTURES	CAPITAL	$13,750,190
	ANNUAL O&M	$0
STORM WATER RENTION POND CLOSURE	CAPITAL	$11,959,631
REMOVAL OF SEDIMENT≥0.35 PPM	ANNUAL O&M	$0
TOTAL	CAPITAL	$359,424,233
	ANNUAL O&M	$0
	PRESENT WOR	$0
	TOTAL	$359,424,233

ALTERNATIVE 3
FENCE MAIN BUILDING AND SOUTH WAREHOUSE

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
FENCE MAIN BUILDING	L.F	$11.80	1436		$16,945	MEANS 1989
PERIMETER= 1454'						
GATES: 3' WIDE	EA	$153.00	2.00		$306	MEANS 1989
GATES: 12' DOUBLE SWING	EA	$507.00	1.00		$507	MEANS 1989
CORNER POSTS	EA	$65.50	10.00		$655	MEANS 1989
FENCE SOUTH WAREHOUSE	L.F	$11.80	485		$5,723	MEANS 1989
PERIMETER= 500'						
GATES: 3' WIDE	EA	$153.00	1.00		$153	MEANS 1989
GATES: 12' DOUBLE SWING	EA	$507.00	1.00		$507	MEANS 1989
CORNER POSTS	EA	$65.50	8.00		$524	MEANS 1989
ANNUAL O&M					$500	
TOTAL CAPITAL COST					$25,320	
ANNUAL O&M					$500	
PRESENT WORTH O&M					$7,685	
TOTAL					$33,005	

ALTERNATIVE 3

CAPITAL COSTS

SURFACE CAP 1

OPERATION	UNIT	UNIT COST	UNITS	LEVELC MULTIPLIER	COST	SOURCE
CUT, FILL, LEVEL PRIOR TO CAPPING (AVE 3 FT CUT & FILL)	C.Y.	$1.26	3322	4	$13,289	MEANS, 1989 P.36 (242-4040)
SOIL LAYER W TOP SOIL	C.Y.	$15.00	2,063		$30,945	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	910		$13,650	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$15.00	1,141		$17,115	ESTIMATING DEPT
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	10,269		$1,951	MEANS, 1988
40 MIL LINER	S.F	$0.40	29,900		$11,960	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	29,900		$4,485	GUNDLE, 9/89
PERIMETER TRENCH						
EXCAVATE	C.Y	$6.00	227	4	$5,440	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	227		$3,400	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	680		$4,080	MEANS, 1988
4" PVC ELBOWS		$6.00	5		$30	MEANS, 1988
SUMP WELL		$500.00	1		$500	ASSUMED
ELEC.SUMP PUMP(6" IMPELLER)		$1,500.00	1		$1,500	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	0.69		$858	ESTIMATING DEPT
CAPITAL COSTS CAP 1					$109,203	

SURFACE CAP 2

OPERATION	UNIT	UNIT COST	UNITS	LEVELC MULTIPLIER	COST	SOURCE
CUT, FILL, LEVEL PRIOR TO CAPPING (AVE 3 FT CUT & FILL)	C.Y.	$1.26	4562	4	$18,249	MEANS, 1989 P.36 (242-4040)
SOIL LAYER W TOP SOIL	C.Y.	$15.00	2,779		$41,685	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	1,193		$17,895	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$15.00	1,522		$22,830	ESTIMATING DEPT

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	13,698		$2,603	MEANS, 1988
40 MIL LINER	S.F	$0.40	41,060		$16,424	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	41,060		$6,159	GUNDLE, 9/89
PERIMETER TRENCH						
EXCAVATE	C.Y	$6.00	393	4	$9,432	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	393		$5,895	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	1180		$7,080	MEANS, 1988
4" PVC ELBOWS		$6.00	15		$90	MEANS, 1988
SUMP WELLS		$500.00	2		$1,000	ESTIMATING DEPT.
ELEC. SUMP PUMP(6" IMPELLER)		$1,500.00	2		$3,000	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	1.63		$2,038	ESTIMATING DEPT
CAPITAL COST CAP 2					$154,379	
SURFACE SOILNOT CAPPED(2 FT DEEP)			5008.5	LEVEL C		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
EXCAVATE W/LOADER	C.Y	$6.00	650	2	$7,800	AVE. EXCAVATION COST USPCI
HAND SHOVEL 2" LIFT	C.Y.	$33.00	59	2	$3,894	MEANS, 1988
FRONT END LOADER	HR	$17.00	59	2	$2,006	MEANS, 1988
OPERATOR	HR	$20.00	59	2	$2,360	MEANS, 1988
BACKFILL	C.Y.	$15.00	709		$10,635	
SUBSURFACE SOIL						
TEST PIT P-1	C.Y	$6.00	8	2	$96	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y.	$6.00	334	2	$4,008	AVE COST OF EXCAVATION(USPCI)
BACKFILL	C.Y.	$15.00	342		$5,130	ESTIMATING DEPT
SUBTOTAL					$35,929	
LANDFILLING						
SOIL NOT CAPPED	TON	$190.00	1,312		$249,214	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL	TON	$190.00	600		$114,040	CHEMICAL WASTE MANAGEMENT
SOUTH WARE STR	TON	$190.00	0		$0	CHEMICAL WASTE MANAGEMENT
SHED	TON	$190.00	0			CHEMICAL WASTE MANAGEMENT
TRANSPORTATION						CHEMICAL WASTE MANAGEMENT
800 MI	LOAD MI	$3.50	106		$296,800	

MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	1,912		$143,390	
LAND FILLING SUBTOTAL					$803,443	
CAPITAL COSTS SUBTOTAL					$993,751	
ENGINEERING AND ADMINISTRATIVE(20%)					$198,750	
HEALTH AND SAFETY-CONTRACTOR(15%)					$149,063	
CONTINGENCIES 25%					$248,438	
TOTAL CAPITAL COST					**$1,590,001**	

OPERATION AND MAINTENANCE	I=5% PRESENT WORTH			ANNUAL		
ANNUAL ENGINEERING INSPECTION	YR	$575		$575	$9,045	COMPENDIUM OF COSTS
DAILY PROPERTY CHECK	MO	$300		$3,600	$56,628	ASSUMED
MOWING(RIDING MOWER)	AC-YR	$26	1.63	$42	$666	MEANS, 1988 P. 88
REPAIRS						
RE-SEEDING, FERTILIZATION	AC-YR	$511	1.63	$512	$8,057	COMPARED TO COMPENDIUM P.10
EROSION CONTROL AND DRAINAGE MAINTENANCE	AC-YR	$200	1.63	$202	$3,172	COMPENDIUM OF COSTS P. 10
REPAIRS TO CAP (SHRINK/ SWELL OR FREEZE THAW)	AC-YR	$200	1.63	$202	$3,172	COMPARED TO COMPENDIUM P. 10
SUMP PUMPING	HR	$4.90	20	$25	$386	MEANS& CALC. 40 IN/YR-6 AC
SUBTOTAL OPERATION AND MAINTENANCE				$5,133	$80,740	
CONTINGENCY(25%)				$1,283	$20,185	
TOTAL OPERATION AND MAINTENANCE				$6,416	$100,924	
TOTAL					$1,690,926	

PART OF ALTERNATIVE 3

INCINERATE MATERIALS REMOVED FROM SITE

CAPITAL COSTS

SURFACE CAP 1

OPERATION	UNIT	UNIT COST	UNITS	LEVELC MULTIPLIER	COST	SOURCE
CUT, FILL, LEVEL PRIOR TO CAPPING (AVE 3 FT CUT & FILL)	C.Y.	$1.26	3322	4	$13,289	MEANS, 1989 P.36 (242-4040)
SOIL LAYER W TOP SOIL	C.Y.	$15.00	2,063		$30,945	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	910		$13,650	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$15.00	1,141		$17,115	ESTIMATING DEPT
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	10,269		$1,951	MEANS, 1988
40 MIL LINER	S.F	$0.40	29,900		$11,960	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	29,900		$4,485	GUNDLE, 9/89
PERIMETER TRENCH						
EXCAVATE	C.Y	$6.00	227	4	$5,440	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	227		$3,400	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	680		$4,080	MEANS, 1988
4" PVC ELBOWS		$6.00	5		$30	MEANS, 1988
SUMP WELL		$500.00	1		$500	ASSUMED
ELEC. SUMP PUMP(6" IMPELLER)		$1,500.00	1		$1,500	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	0.69		$858	ESTIMATING DEPT
CAPITAL COSTS CAP 1					$109,203	

SURFACE CAP 2

OPERATION	UNIT	UNIT COST	UNITS	LEVELC MULTIPLIER	COST	SOURCE
CUT, FILL, LEVEL PRIOR TO CAPPING (AVE 3 FT CUT & FILL)	C.Y.	$1.26	4562	4	$18,249	MEANS, 1989 P.36 (242-4040)
SOIL LAYER W TOP SOIL	C.Y.	$15.00	2,779		$41,685	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	1,193		$17,895	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$15.00	1,522		$22,830	ESTIMATING DEPT
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	13,698		$2,603	MEANS, 1988
40 MIL LINER	S.F	$0.40	41,060		$16,424	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	41,060		$6,159	GUNDLE, 9/89

PERIMETER TRENCH						
EXCAVATE	C.Y	$6.00	393	4	$9,432	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	393		$5,895	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	1180		$7,080	MEANS, 1988
4" PVC ELBOWS		$6.00	15		$90	MEANS, 1988
SUMP WELLS		$500.00	2		$1,000	ESTIMATING DEPT.
ELEC. SUMP PUMP(6" IMPELLER)		$1,500.00	2		$3,000	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	1.63		$2,038	ESTIMATING DEPT
CAPITAL COST CAP 2					$154,379	

SURFACE SOILNOT CAPPED(2 FT DEEP)			5008.5	LEVEL C		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
EXCAVATE W/LOADER	C.Y	$6.00	650	2	$7,800	AVE. EXCAVATION COST USPCI
HAND SHOVEL 2" LIFT	C.Y.	$33.00	59	2	$3,894	MEANS, 1988
FRONT END LOADER	HR	$17.00	59	2	$2,006	MEANS, 1988
OPERATOR	HR	$20.00	59	2	$2,360	MEANS, 1988
BACKFILL	C.Y.	$15.00	709		$10,635	
SUBSURFACE SOIL						
TEST PIT P-1	C.Y	$6.00	8	2	$96	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y.	$6.00	334	2	$4,008	AVE COST OF EXCAVATION(USPCI)
BACKFILL	C.Y.	$15.00	342		$5,130	ESTIMATING DEPT
SUBTOTAL					$35,929	

INCINERATION						
SOIL NOT CAPPED	TON	$2,000.00	1,312		$2,623,300	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL	TON	$2,000.00	600		$1,200,420	CHEMICAL WASTE MANAGEMENT
SOUTH WARE STR	TON	$2,000.00	0		$0	CHEMICAL WASTE MANAGEMENT
SHED	TON	$2,000.00	0			CHEMICAL WASTE MANAGEMENT
TRANSPORTATION						CHEMICAL WASTE MANAGEMENT
800 MI	LOAD MI	$3.50	106		$296,800	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	1,912		$143,390	
LAND FILLING SUBTOTAL					$4,263,910	

CAPITAL COST SUBTOTAL		$4,454,218
ENGINEERING AND ADMINISTRATIVE(20%)		$177,104
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING	$132,828
CONTINGENCIES 25%		$221,380
TOTAL CAPITAL COST		**$4,985,530**

OPERATION AND MAINTENANCE	I=5% PRESENT WORTH			ANNUAL		
ANNUAL ENGINEERING INSPECTION	YR	$575		$575	$9,045	COMPENDIUM OF COSTS
DAILY PROPERTY CHECK	MO	$300		$3,600	$56,628	ASSUMED
MOWING(RIDING MOWER)	AC-YR	$26	1.63	$42	$666	MEANS, 1988 P. 88
REPAIRS						
RE-SEEDING, FERTILIZATION	AC-YR	$511	1.63	$512	$8,057	COMPARED TO COMPENDIUM P.10
EROSION CONTROL AND DRAINAGE MAINTENANCE	AC-YR	$200	1.63	$202	$3,172	COMPENDIUM OF COSTS P. 10
REPAIRS TO CAP (SHRINK/ SWELL OR FREEZE THAW)	AC-YR	$200	1.63	$202	$3,172	COMPARED TO COMPENDIUM P. 10
SUMP PUMPING	HR	$4.90	20	$25	$386	MEANS& CALC. 40 IN/YR-6 AC
SUBTOTAL OPERATION AND MAINTENANCE				$5,133	$80,740	
CONTINGENCY(25%)				$1,283	$20,185	
TOTAL OPERATION AND MAINTENANCE				$6,416	$100,924	
TOTAL					$5,086,454	

EXCAVATION OF DITCH ONLY--CAPPING ALTERNATIVES 3 ,4A,5 ,6A

PUMPING OF POND PRIOR TO CAPPING

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED.					
	SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
BACKFILL WITH SOIL	C.Y	$15.00	300		$4,500	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE &						
2" IMPELLER)	DAY	$17.70	1		$18	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	20		$7	MEANS 1989, P14
ACTIVATED CARBON TREATMENT	GAL	$0.30	60588		$18,176	COMPENDIUM OF COSTS
(50 GPM ASSUMED AS UNIT CAPACITY)						P. 109
DISCHARGE TO POTW	1000GAL	$1.00	61		$61	ESTIMATE
EXCAVATE DITCH W/BACKHOE	C.Y	$5.00	34	4	$680	ABOUT AVE COST OF EXCAVATION (USPCI)
BACKFILL		$15.00	34		$510	ESTIMATING DEPT
LANDFILL DITCH	TON	$190.00	63		$11,951	CHEM. WASTE MANAGEMENT
TRANSPORTION TO LANDFILL	LOAD-MI	$3.50	3		$8,400	WELL ESTABLISHED
MISC.(TAXES, ANALSIS, PERMITS)	TON	$75.00	63		$4,718	
SUBTOTAL EXPENSE SPCC					$49,020	3,
ENGINEERING AND ADMINISTRATIVE (20%)					$9,804	
HEALTH AND SAFETY-CONTRACTOR(15%)					$7,353	
CONTINGENCIES 25%					$12,255	
TOTAL CAPITAL COSTS					$78,433	

DEMOLITION OF RENTENTION PONDS--ALTERNATIVES 3,4,5,6,7

BACKFILL WITH SOIL	C.Y	$15.00	2400		$36,000	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE &						
2" IMPELLER)	DAY	$17.70	6.73		$119	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	162		$58	MEANS 1989, P14
ACTIVATED CARBON TREATMENT	GAL	$0.30	484704		$145,411	COMPENDIUM OF COSTS
(50 GPM ASSUMED AS UNIT CAPACITY)						P. 109

DISCHARGE TO POTW	1000GAL	$1.00	485		$485	ESTIMATE
SUBTOTAL EXPENSE FOR RETENTION PONDS					$182,073	3,
ENGINEERING AND ADMINISTRATIVE(10%)					$36,415	
HEALTH AND SAFETY-CONTRACTOR(15%)					$27,311	
CONTINGENCIES 25%					$45,518	
TOTAL CAPITAL COSTS					$291,317	

REMOVAL OF SEDIMENT FROM SPILL CONTAINMENT POND, DITCH EXCEEDING 10 PPM PCBS
ALTERNATIVE 4B, 6B, 7 , 8 REMOVAL

				LEVEL C		
EXCAVATE DITCH W/BACKHOE	C.Y	$5.00	34	4	$680	
EXCAVATE SPCC W/LOADER	C.Y.	$5.00	50	4	$1,000	
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED.					
	SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
HANDSHOVEL 2" LIFT SPCC POND	C.Y.	$33.00	10	4	$1,320	
FRONT END LOADER	HR	$17.00	10	4	$680	
OPERATOR	HR	$20.00	10	4	$800	
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE &						
2" IMPELLER)	DAY	$17.70	1		$18	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	20		$7	MEANS 1989, P14
ACTIVATED CARBON TREATMENT	GAL	$0.30	60588		$18,176	COMPENDIUM OF COSTS
(50 GPM ASSUMED AS UNIT CAPACITY)						P. 109
DISCHARGE TO POTW	1000GAL	$1.00	61		$61	
BACKFILL	C.Y	$15.00	94		$1,410	
LANDFILL	TON	$190.00	174		$33,041	
TRANSPORTATION TO LANDFILL	LOAD-MI	$3.50	10		$28,000	
MISC(TAXES,ANALSIS,PERMITS)	TON	$75.00	174		$13,043	
SUBTOTAL					$98,235	
ENGINEERING AND ADMINISTRATIVE(20%)					$19,647	
HEALTH AND SAFETY-CONTRACTOR(15%)					$14,735	
CONTINGENCIES 25%					$24,559	
TOTAL CAPITAL COSTS					$157,177	

INCINERATION OF REMOVED MATERIALS
EXCAVATION OF DITCH--CAPPING ALT 3 ,4A,5 ,6A
PUMPING OF SPILL CONTAINMENT POND

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	SOURCE
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED. SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
BACKFILL WITH SOIL	C.Y	$15.00	300		$4,500	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE & 2" IMPELLER)	DAY	$17.70	1		$18	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	20		$7	MEANS 1989, P14
ACTIVATED CARBON TREATMENT (50 GPM ASSUMED AS UNIT CAPACITY)	GAL	$0.30	60588		$18,176	COMPENDIUM OF COSTS P. 109
DISCHARGE TO POTW	1000GAL	$1.00	61		$61	ESTIMATE
EXCAVATE DITCH W/BACKHOE	C.Y	$5.00	34	4	$680	ABOUT AVE COST OF EXCAVATION (USPCI)
BACKFILL		$15.00	34		$510	ESTIMATING DEPT
INCINERATE DITCH	TON	$2,000.00	63		$125,800	CHEM. WASTE MANAGEMENT
TRANSPORTION TO LANDFILL	LOAD-MI	$3.50	3		$8,400	WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	63		$4,718	
SUBTOTAL EXPENSE SPCC					$162,869	3,
ENGINEERING AND ADMINISTRATIVE(20%)					$10,279	
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING				$7,710	
CONTINGENCIES 25%					$12,849	
TOTAL CAPITAL COSTS					$193,708	

CLOSURE OF RENTENTION PONDS--ALTERNATIVES 3,4,5,6,7

BACKFILL WITH SOIL	C.Y	$15.00	2400		$36,000	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE & 2" IMPELLER)	DAY	$17.70	6.73		$119	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	162		$58	MEANS 1989, P14
ACTIVATED CARBON TREATMENT (50 GPM ASSUMED AS UNIT CAPACITY)	GAL	$0.30	484704		$145,411	COMPENDIUM OF COSTS P. 109

DISCHARGE TO POTW	1000GAL	$1.00	485		$485	ESTIMATE
SUBTOTAL EXPENSE FOR RETENTION PONDS					$182,073	3,
ENGINEERING AND ADMINISTRATIVE(20%)					$36,415	
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING				$27,311	
CONTINGENCIES 25%					$45,518	
TOTAL CAPITAL COSTS					$291,317	

REMOVAL OF SEDIMENT FROM SPILL CONTAINMENT POND, DITCH EXCEEDING 10 PPM PCBS
ALTERNATIVE 4B, 5 , 6B, 7 , 8 REMOVAL

				LEVEL C		
EXCAVATE DITCH W/BACKHOE	C.Y	$5.00	34	4	$680	
EXCAVATE SPCC W/LOADER	C.Y.	$5.00	50	4	$1,000	
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED. SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
HANDSHOVEL 2" LIFT SPCC POND	C.Y.	$33.00	10	4	$1,320	
FRONT END LOADER	HR	$17.00	10	4	$680	
OPERATOR	HR	$20.00	10	4	$800	
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE & 2" IMPELLER)	DAY	$17.70	1		$18	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	20		$7	MEANS 1989, P14
ACTIVATED CARBON TREATMENT (50 GPM ASSUMED AS UNIT CAPACITY)	GAL	$0.30	60588		$18,176	COMPENDIUM OF COSTS P. 109
DISCHARGE TO POTW	1000GAL	$1.00	61		$61	
BACKFILL	C.Y	$15.00	94		$1,410	
INCINERATE	TON	$2,000.00	174		$347,800	
TRANSPORTATION TO LANDFILL	LOAD-MI	$3.50	10		$28,000	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	174		$13,043	
SUBTOTAL					$412,994	
ENGINEERING AND ADMINISTRATIVE(20%)					$18,449	
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING				$13,836	
CONTINGENCIES 25%					$23,061	
TOTAL CAPITAL COSTS					$468,340	

UN-NAMED TRIBUTARY ON-SITE(300 FT LENGTH) ALTERNATIVES 3,4,5,6,7,8

LANDFILL MATERIALS REMOVED

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	SOURCE
CLEAR TREES ALONG CREEK						
250'x 14' SWATH	AC	$3,200.00	0.08	4	$1,024	MEANS, 1988
W/ 300 H.P DOZER						
DOZE PATH W/ 300 H.P DOZER						
CUT AND FILL 4 PASSES						
4" LIFTS	C.Y	$3.00	173	4	$2,076	MEANS, 1988
EXCAVATE W/ BACKHOE OR SUCKER	C.Y	$6.00	129	4	$3,096	AVE. COST EXCAVATE (USPCI)
HAND LABOR SHOVEL ASSIST	C.Y.	$33.00	20	4	$2,640	MEANS, 1988
BACKHOE	HR.	$10.00	20	4	$800	MEANS, 1988
BACKHOE OPER.	HR.	$20.00	20	4	$1,600	MEANS, 1988
SEDIMENT DEWATERING --THE STREAM IS NORMALY DRY IN SUMMER MONTHS.						
SEDIMENT IS SAND AND GRAVEL IN POCKETS SEVERAL INCHES DEEP						
BACKFILL WITH SAND/GRAVEL	C.Y.	$15.00	149		$2,235	
SUBTOTAL					$13,471	
LANDFILLING AT EMELLE						
UNNAMED TRIB. SEDIMENT	TON	$190.00	276		$52,374	CHEMICAL WASTE MANAGEMENT
BRUSH, TREES	TON	$190.00	36		$6,840	TREES, BRUSH ESTIMATED
TRANSPORTATION						
800 MI	LOAD MI	$3.50	17		$47,600	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES, ANALSIS, PERMITS)	TON	$75.00	312		$23,374	
SUBTOTAL					$130,187	
POST CLEANUP SAMPLING						
UNNAMED TRIBUTARY, ONSITE						
COLLECT	DAY	$200.00	0.5		$100	$200.00/ DAY
PACK, SHIP		$12.00			$12	ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	6		$1,122	EMS W/O VOLUME DISCOUNT
SUBTOTAL					$1,234	
TOTAL					$144,892	

ENGINEERING AND ADMINISTRATIVE(20%)	$28,978
HEALTHAND SAFETY-CONTRACTOR(15%)	$21,734
CONTINGENCIES 25%	$36,223
TOTAL CAPITAL EXPENSE	$231,828

UN-NAMED TRIBUTARY ON-SITE(300 FT LENGTH)-- ALTERNATIVES 3,4,5,6,7,8

INCINERATE MATERIALS REMOVED FROM SITE

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	SOURCE
CLEAR TREES ALONG CREEK						
250'x 14' SWATH	AC	$3,200.00	0.08	4	$1,024	MEANS, 1988
W/300 H.P DOZER						
DOZE PATH W/300 H.P DOZER						
CUT AND FILL 4 PASSES						
4" LIFTS	C.Y	$3.00	173	4	$2,076	MEANS, 1988
EXCAVATE W/ BACKHOE OR SUCKER	C.Y	$6.00	129	4	$3,096	AVE. COST EXCAVATE (USPCI)
HAND LABOR SHOVEL ASSIST	C.Y.	$33.00	20	4	$2,640	MEANS, 1988
BACKHOE	HR.	$10.00	20	4	$800	MEANS, 1988
BACKHOE OPER.	HR.	$20.00	20	4	$1,600	MEANS, 1988
SEDIMENT DEWATERING --THE STREAM IS NORMALY DRY IN SUMMER MONTHS.						
SEDIMENT IS SAND AND GRAVEL IN POCKETS SEVERAL INCHES DEEP						
BACKFILL WITH SAND/GRAVEL	C.Y.	$15.00	149		$2,235	
SUBTOTAL					$13,471	
INCINERATION						
UNNAMED TRIB. SEDIMENT	TON	$2,000.00	276		$551,300	CHEMICAL WASTE MANAGEMENT
BRUSH, TREES	TON	$2,000.00	36		$72,000	TREES, BRUSH ESTIMATED
TRANSPORTATION						
800 MI	LOAD MI	$3.50	17		$47,600	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	312		$23,374	
SUBTOTAL					$694,274	
POST CLEANUP SAMPLING						
UNNAMED TRIBUTARY, ONSITE						
COLLECT	DAY	$200.00	0.5		$100	$200.00/ DAY
PACK, SHIP		$12.00			$12	ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	6		$1,122	EMS W/O VOLUME DISCOUNT
SUBTOTAL					$1,234	
TOTAL					$708,979	

ENGINEERING AND ADMINISTRATIVE(20%)		$28,978
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING	$21,734
CONTINGENCIES 25%		$36,223
TOTAL CAPITAL EXPENSE		$745,202

ALTERNATIVES 3,4,5,6,7,8, A: LANDFILL MATERIALS REMOVED

CAPITAL COSTS

BUILD ACCESS ROAD, DIKE CREEK , PUMP EXCESS WATER, AND REMOVE SEDIMENT FOR EAST PIN OAK CREEK(600 FT. LENGTH)

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	SOURCE
EXCAVATION AND LOADING: EAST PIN OAK CREEK						
MOBILIZE 300 H.P. DOZER		$230.00			$230	MEANS, 1988
CLEAR TREES ALONG EAST PIN OAK CREEK						
700' x 14' SWATH	AC	$3,200.00	0.225	4	$2,880	MEANS, 1988
W/ 300 H.P DOZER						
DOZE PATH W/ 300 H.P DOZER						
CUT AND FILL 4 PASSES						
4" LIFTS	C.Y	$3.00	415		$1,244	MEANS, 1988
EXCAVATE W/BACKHOE OR SUCKER	C.Y	$6.00	348	4	$8,352	AVERAGE COST EXCAVATE USPCI
MOBILIZATION OF EQUIPMENT		$200.00			$200	ASSUMED
SEDIMENT DEWATERING	TON	$20.00	469.8		$9,396	ASSUMED
TREATMENT OF WATER	GAL	$0.30	70282		$21,085	COMPENDIUM OF COSTS, USEPA
DIVERSION OF OUTFALL TO 550' DOWNSTREAM						
AND DEWATERING OF CREEK						
600' OF 6" PVC LINE	L.F	$4.00	550		$2,200	MEANS, 1988
MISC FITTINGS					$500	ASSUMED
LAY LINE	L.F	$2.51	550		$1,381	MEANS 1988
PUMP RENTAL(W SMALL DIESEL ENGINE &						
6" IMPELLER)	WEEK	$365.00	1		$365	MEANS, 1988
FUEL	GAL	$1.00	50		$50	ASSUMED
LABOR FOR SEMI-ATTENDED PUMPING	HR	$16.55	28		$463	MEANS, 1988
DOZE TEMPORARY SOIL DIKE					$500	ASSUMED
BACKFILL WITH SAND/GRAVEL	C.Y.	$15.00	348		$5,220	ESTIMATING DEPT.
EAST PIN OAK CREEK EXCAVATION SUBTOTAL					$54,066	
POST CLEANUP SAMPLING EAST PIN OAK CREEK						
ASSUME 13 SAMPLES						
COLLECT	DAY	$200.00	1.08		$217	12 SAMPLES PER DAY @ $200
PACK, SHIP		$26.00				ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	13		$2,431	COST EMS LABS, W/O DISCOUNT

EAST PIN OAK CREEK SAMPLING SUBTOTAL					$2,648	
REMOVAL OF SEDIMENT FROM UNNAMED TRIBUTARY OFFSITE(800 FT LENGTH)						
EXCAVATE W/BACKHOE	C.Y	$6.00	329	4	$7,896	AVE. COST EXCAVATION (USPCI)
BACKFILL W/ SAND/GRAVEL	C.Y	$15.00	329		$4,935	ESTIMATING DEPT.
POST CLEANUP SAMPLING OF UNNAMED TRIBUTARY OFFSITE						
ASSUME 18 SAMPLES						
COLLECT,	DAY	$200.00	1.5		$300	12 SAMPLES PER DAY @ $200
PACK, SHIP		$36.00				ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	18		$3,366	COST EMS LABS, W/O DISCOUNT
OFF-SITE UNNAMED TRIB. SUBTOTAL					$16,497	
LANDFILLING						
PIN OAK CREEK SEDIMENT(+35% FLY ASH)	TON	$190.00	634		$120,504	CHEMICAL WASTE MANAGEMENT
OFFSITE UNNAMED CREEK SEDIMENT	TON	$190.00	577		$109,705	"
TRANSPORTATION 800 MI	LOAD MI	3.5	67		$187,600	WELL ESTABLISHED COST
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	1,212		$90,872	
LANDFILLING SUBTOTAL					$508,681	
SUBTOTAL					$581,891	
ENGINEERING AND ADMINISTRATIVE(20%)					$116,378	
HEALTH AND SAFETY-CONTRACTOR(15%)					$87,284	
CONTINGENCY(25%)					$145,473	
TOTAL CAPITAL COSTS					$931,026	

ALTERNATIVES 3,4,5,6,7,8, B: INCINERATE MATERIALS REMOVED FROM SITE
CAPITAL COSTS

REMOVE SEDIMENT FROM EAST PIN OAK CREEK(600 FT LENGTH)

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	SOURCE
EXCAVATION AND LOADING: EAST PIN OAK CREEK						
MOBILIZE 300 H.P. DOZER		$230.00			$230	MEANS, 1988
CLEAR TREES ALONG EAST PIN OAK CREEK						
700' x 14' SWATH	AC	$3,200.00	0.225	4	$2,880	MEANS, 1988
W/ 300 H.P DOZER						
DOZE PATH W/ 300 H.P DOZER						
CUT AND FILL 4 PASSES						
4" LIFTS	C.Y	$3.00	415		$1,244	MEANS, 1988
EXCAVATE W/BACKHOE OR SUCKER	C.Y	$6.00	348	4	$8,352	AVERAGE COST EXCAVATE USPCI
MOBILIZATION OF EQUIPMENT		$200.00			$200	ASSUMED
SEDIMENT DEWATERING	TON	$20.00	470		$9,396	ASSUMED
TREATMENT OF WATER	GAL	$0.30	70282		$21,085	COMPENDIUM OF COSTS, USEPA
DIVERSION OF OUTFALL TO 550' DOWNSTREAM						
AND DEWATERING OF CREEK						
600' OF 6" PVC LINE	L.F	$4.00	550		$2,200	MEANS, 1988
MISC FITTINGS					$500	ASSUMED
LAY LINE	L.F	$2.51	550		$1,381	MEANS 1988
PUMP RENTAL(W SMALL DIESEL ENGINE &						
6" IMPELLER)	WEEK	$365.00	1		$365	MEANS, 1988
FUEL	GAL	$1.00	50		$50	ASSUMED
LABOR FOR SEMI-ATTENDED PUMPING	HR	$16.55	28		$463	MEANS, 1988
DOZE TEMPORARY SOIL DIKE					$500	ASSUMED
BACKFILL WITH SAND/GRAVEL	C.Y.	$15.00	348		$5,220	ESTIMATING DEPT.
EAST PIN OAK CREEK EXCAVATION SUBTOTAL					$54,066	
POST CLEANUP SAMPLING EAST PIN OAK CREEK						
ASSUME 13 SAMPLES						
COLLECT	DAY	$200.00	1.08		$217	12 SAMPLES PER DAY @ $200
PACK, SHIP		$26.00				ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	13		$2,431	COST EMS LABS, W/O DISCOUNT

EAST PIN OAK CREEK SAMPLING SUBTOTAL					$2,648	
REMOVAL OF SEDIMENT FROM UNNAMED TRIBUTARY OFFSITE(800 FT LENGTH)						
EXCAVATE W/BACKHOE	C.Y	$6.00	329	4	$7,896	AVE. COST EXCAVATION (USPCI)
BACKFILL W/ SAND/GRAVEL	C.Y	$15.00	329		$4,935	ESTIMATING DEPT.
POST CLEANUP SAMPLING OF UNNAMED TRIBUTARY OFFSITE						
ASSUME 18 SAMPLES						
COLLECT,	DAY	$200.00	1.5		$300	12 SAMPLES PER DAY @ $200
PACK, SHIP		$36.00				ASSUME $2.00/SAMPLE
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	18		$3,366	COST EMS LABS, W/O DISCOUNT
OFF-SITE UNNAMED TRIB. SUBTOTAL					$16,497	
INCINERATION						
PIN OAK CREEK SEDIMENT(+35% FLY ASH)	TON	$2,000.00	634		$1,268,460	CHEMICAL WASTE MANAGEMENT
OFFSITE UNNAMED CREEK SEDIMENT	TON	$2,000.00	577		$1,154,790	"
TRANSPORTATION 800 MI	LOAD MI	3.5	67		$187,600	WELL ESTABLISHED COST
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	1,212		$90,872	
LANDFILLING SUBTOTAL					$2,701,722	
SUBTOTAL					$2,774,932	
ENGINEERING AND ADMINISTRATIVE(20%)					$126,550	
HEALTH AND SAFETY-CONTRACTOR(15%)		SAME AS LANDFILLIMG			$94,913	
CONTINGENCY(25%)					$158,188	
TOTAL CAPITAL COSTS					$3,154,583	

DECONTAMINATION OF BUILDINGS AND STRUCTURES-ALTERNATIVE 4
LANDFILLING OF MATERIALS REMOVED FROM SITE

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
STRUCTURES: MAIN BUILDING						
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	250,000		$50,000	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES	S.F.	$4.00	150,000		$600,000	ENSR $4.00 TO $5.00 SQ FT
SCARIFICATION TO .25 IN	C.F.	$200.00	1,952		$390,417	ENSR $200 TO $300 CU FT
REMOVE 10% OF SLAB 7" SLAB MESH REINFORCED	CY	$30.00	202	4	$24,293	ESTIMATE
ENCAPSULATE 30% OF SLAB	S.F.	$7.00	28,110		$196,770	ENSR-EPOXY BASED ENCAPSULANT
LANDFILL INSULATION	TON	$190.00	10		$1,900	
LANDFILL 10% OF SLAB	TON	$190.00	410		$77,888	CHEMICAL WASTE MANAGEMENT
LANDFILL SCARIFICATION PASTE	TON	$190.00	146		$27,817	
ON-SITE SAMPLE ANALYSIS	ESTIMATE				$116,000	ASSUMED TO BE 25% OF FINAL
TRANSPORTATION	LOAD MI	$3.50	31		$86,542	
MISC.(TAXES, ANALYSIS, PERMITS)	TON	$75.00	556		$41,726	
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)	SAMPLE	$185.00	2,500		$462,500	EMS LABS, W/O VOL DISCOUNT
SUBTOTAL FOR MAIN BUILDING					2,075,853	
SOUTH WAREHOUSE						
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	19,750		$3,950	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES	S.F.	$4.00	10,000		$40,000	ENSR
SCARIFICATION TO .25 IN	C.F.	$200.00	203		$40,625	ENSR
REMOVE 10% OF SLAB						

7" SLAB MESH REINFORCED	C.Y	$30.00	21	4	$2,528	$30/CU YD NORMAL FOR NON-HAZ.
ENCAPSULATE 30% OF SLAB	S.F.	$7.00	2,910		$20,370	ENSR-EPOXY BASED ENCAPSULANT
LANDFILL INSULATION	TON	$190.00	2		$380	
LANDFILL10% OF SLAB	TON	$190.00	43		$8,105	CHEMICAL WASTE MANAGEMENT
LANDFILL SCARIFICATION PASTE	TON	$190.00	15		$2,895	
TRANSPORTATION	LOAD MI	$3.50	3		$9,005	
MISC.(TAXES,ANALYSIS, PERMITS)	TON	$75.00	58		$4,342	
ON-SITE SAMPLE ANALYSIS	ESTIMATE				$9,111	ASSUMED TO BE 25% OF FINAL
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)	SAMPLE	$185.00	197		$36,445	EMS LABS/ W/O VOL. DISCOUNT
SUBTOTAL FOR SOUTH WAREHOUSE					$177,753	
SUBTOTAL					$2,253,608	
ENGINEERING AND ADMINISTRATIVE(20%)					$450,722	
HEALTH AND SAFETY-CONTRACTOR(15%)					$338,041	
CONTINGENCIES(25%)					$563,402	
TOTAL CAPITAL COSTS					$3,605,773	

DECONTAMINATION OF BUILDINGS AND STRUCTURES-ALTERNATIVE 4
INCINERATE MATERIALS REMOVED FROM THE SITE

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
STRUCTURES: MAIN BUILDING						
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	250,000		$50,000	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES	S.F.	$4.00	150,000		$600,000	ENSR $4.00 TO $5.00 SQ FT
SCARIFICATION TO .25 IN	C.F.	$200.00	1,952		$390,417	ENSR $200 TO $300 CU FT
REMOVE 10% OF SLAB						
7" SLAB MESH REINFORCED	CY	$30.00	202	4	$24,293	ESTIMATE
ENCAPSULATE 30% OF SLAB	S.F.	$7.00	28,110		$196,770	ENSR-EPOXY BASED ENCAPSULANT
INCINERATE INSULATION	TON	$2,000.00	10		$20,000	
INCINERATE 10% OF SLAB	TON	$2,000.00	410		$819,875	CHEMICAL WASTE MANAGEMENT
INCINERATE SCARIFICATION PASTE	TON	$2,000.00	146		$292,813	
ON-SITE SAMPLE ANALYSIS	ESTIMATE				$116,000	ASSUMED TO BE 25% OF FINAL
TRANSPORTATION	LOAD MI	$3.50	31		$86,542	
MISC.(TAXES, ANALYSIS, PERMITS)	TON	$75.00	556		$41,726	
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)	SAMPLE	$185.00	2,500		$462,500	EMS LABS, W/O VOL DISCOUNT
SUBTOTAL FOR MAIN BUILDING					3,100,935	
SOUTH WAREHOUSE						
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	19,750		$3,950	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES	S.F.	$4.00	10,000		$40,000	ENSR
SCARIFICATION TO .25 IN	C.F.	$200.00	203		$40,625	ENSR
REMOVE 10% OF SLAB						

7"SLAB MESH REINFORCED	C.Y	$30.00	21	4	$2,528	$30/CU YD NORMAL FOR NON-HAZ.
ENCAPSULATE 30% OF SLAB	S.F.	$7.00	2,910		$20,370	ENSR-EPOXY BASED ENCAPSULANT
INCINERATE INSULATION	TON	$2,000.00	2		$4,000	
INCINERATE10% OF SLAB	TON	$2,000.00	43		$85,313	CHEMICAL WASTE MANAGEMENT
INCINERATE SCARIFICATION PASTE	TON	$2,000.00	15		$30,469	
TRANSPORTATION	LOAD MI	$3.50	3		$9,005	
MISC.(TAXES,ANALYSIS, PERMITS)	TON	$75.00	58		$4,342	
ON-SITE SAMPLE ANALYSIS	ESTIMATE				$9,111	ASSUMED TO BE 25% OF FINAL
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)	SAMPLE	$185.00	197		$36,445	EMS LABS/ W/O VOL. DISCOUNT
SUBTOTAL FOR SOUTH WAREHOUSE					$286,157	
SUBTOTAL					$3,387,092	
ENGINEERING AND ADMINISTRATIVE(20%)					$450,266	
HEALTH AND SAFETY-CONTRACTOR(15%)					$337,699	
CONTINGENCIES(25%)					$562,832	
TOTAL CAPITAL COSTS					$4,737,889	

REMOVAL OF SOILS ≥ 10 PPM PCBS--ALTERNATIVE 4
LANDFILLING OF MATERIAL REMOVED FROM SITE
SURFACE SOIL (35,000 S.F.)

SURFACE SOILS > 10 PPM PCBS						
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
EXCAVATE W/LOADER	C.Y	$6.00	2,377	4	$57,037	AVE COST OF EXCAVATION(USPCI)
HAND SHOVEL 2" LIFT	C.Y.	$33.00	216	4	$28,519	MEANS, 1988
FRONT END LOADER	HR	$17.00	27	4	$1,836	MEANS, 1988
OPERATOR	HR	$20.00	27	4	$2,160	MEANS, 1988
BACKFILL W SOIL	C.Y	$15.00	2,593		$38,889	ESTIMATING DEPT.
SUBSURFACE SOIL						
SUBSURFACE SOILS > 10 PPM PCBS						
TEST PIT P-1	C.Y	$6.00	8	4	$192	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y	$6.00	334	4	$8,016	AVE COST OF EXCAVATION(USPCI)
BACKFILL W SOIL	C.Y	$15.00	342		$5,130	ESTIMATING DEPT.
SUBTOTAL					$141,779	
LANDFILLING						
SURFACE SOIL(130 PCF)	TON	$190.00	4,550		$864,500	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL(130 PCF)	TON	$190.00	600		$114,040	CHEMICAL WASTE MANAGEMENT
TRANSPORTATION						
800 MI	LOAD MI	$3.50	286		$800,800	$3.00 TO $3.50 WELL DOCUMENTED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	5,150		$386,266	
SUBTOTAL					$2,165,606	
POST CLEANUP SAMPLING						
SURFACE						
COLLECT, PACK, SHIP	DAY	$200.00	2.95		$590	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	59		$11,033	EMS LABS, W/O VOL. DISCOUNT
SUBSURFACE						
COLLECT, PACK, SHIP	DAY	$200.00	0.60		$120	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	12		$2,244	EMS LABS, W/O VOL. DISCOUNT
SUBTOTAL					$13,987	

TOTAL	$2,321,372
ENGINERING AND ADMINISTRATIVE(20%)	$464,274
HEALTHAND SAFETY-CONTRACTOR(15%)	$348,206
CONTINGENCIES 25%	$580,343
TOTAL CAPITAL COSTS	$3,714,195

REMOVAL OF SOILS ≥ 10 PPM PCBS--ALTERNATIVE 4
INCINERATE MATERIALS REMOVED FROM SITE
SURFACE SOIL (35,000 S.F.)

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
SURFACE SOILS > 10 PPM PCBS						
EXCAVATE W/LOADER	C.Y	$6.00	2,377	4	$57,037	AVE COST OF EXCAVATION(USPCI)
HAND SHOVEL 2" LIFT	C.Y.	$33.00	216	4	$28,519	MEANS, 1988
FRONT END LOADER	HR	$17.00	27	4	$1,836	MEANS, 1988
OPERATOR	HR	$20.00	27	4	$2,160	MEANS, 1988
BACKFILL W SOIL	C.Y	$15.00	2,593		$38,889	ESTIMATING DEPT.
SUBSURFACE SOIL						
SUBSURFACE SOILS > 10 PPM PCBS						
TEST PIT P-1	C.Y	$6.00	8	4	$192	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y	$6.00	334	4	$8,016	AVE COST OF EXCAVATION(USPCI)
BACKFILL W SOIL	C.Y	$15.00	342		$5,130	ESTIMATING DEPT.
SUBTOTAL					$141,779	
INCINERATION						
SURFACE SOIL(130 PCF)	TON	$2,000.00	4,550		$9,100,000	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL(130 PCF)	TON	$2,000.00	600		$1,200,420	CHEMICAL WASTE MANAGEMENT
TRANSPORTATION						
800 MI	LOAD MI	$3.50	286		$800,800	$3.00 TO $3.50 WELL DOCUMENTED
MISC.(TAXES, ANALSIS, PERMITS)	TON	$75.00	5,150		$386,266	
SUBTOTAL					$11,487,486	
POST CLEANUP SAMPLING						
SURFACE						
COLLECT, PACK, SHIP	DAY	$200.00	2.95		$590	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	59		$11,033	EMS LABS, W/O VOL. DISCOUNT
SUBSURFACE						
COLLECT, PACK, SHIP	DAY	$200.00	0.60		$120	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	12		$2,244	EMS LABS, W/O VOL. DISCOUNT
SUBTOTAL					$13,987	

TOTAL		$11,643,252
ENGINEERING AND ADMINISTRATIVE(20%)		$464,274
HEALTHAND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING OPTION	$348,206
CONTINGENCIES 25%		$580,343
TOTAL CAPITAL COSTS		$13,036,075

CAP ALTERNATIVE 5
LANDFILL ANY MATERIALS THAT ARE REMOVED FROM THE SITE

CAPITAL COSTS

SURFACE CAPPING				LEVELC		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
CUT FILL AND LEVEL PRIOR TO CAPPING	C.Y.	$1.26	7884	4	$39,735	
(AVE. 3 FT CUT AND FILL)						
SOIL LAYER W TOP SOIL	C.Y.	$7.00	18,750		$131,250	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	8,920		$133,800	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$7.00	17,550		$122,850	ESTIMATING DEPT
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	157,950		$30,011	MEANS, 1988
40 MIL LINER	S.F	$0.40	275,000		$110,000	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	275,000		$41,250	GUNDLE, 9/89
PERIMETER TRENCH(2715' LENGTH)						
EXCAVATE	C.Y	$6.00	830	4	$19,920	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	822		$12,330	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	2715		$16,290	MEANS, 1988
4" PVC ELBOWS		$6.00	11		$66	MEANS, 1988
SUMP WELLS		$500.00	4		$2,000	ESTIMATING DEPT.
ELEC. SUMP PUMP(6" IMPELLER)		$1,500.00	4		$6,000	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	6		$7,500	ESTIMATING
SUB-TOTAL					$673,002	

SURFACE SOIL NOT CAPPED(2 FT DEEP)			5008.5	LEVEL C		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
EXCAVATE W/LOADER	C.Y	$6.00	381	4	$9,144	AVE. EXCAVATION COST USPCI
HAND SHOVEL 2" LIFT	C.Y.	$33.00	31	4	$4,066	MEANS, 1988
FRONT END LOADER	HR	$17.00	31	4	$2,094	MEANS, 1988
OPERATOR	HR	$20.00	31	4	$2,464	MEANS, 1988

CONCRETE REMOVAL ALONG PROPERTY LINE			5008.5	LEVEL C		
REMOVE CONCRETE	C.Y	$30.00	210	4	$25,200	
SUBTOTAL					$42,968	
LANDFILLING						
PERIMETER TRENCH EXCAVATION(OPTION)	TON	$190.00	1,536		$291,745	CHEMICAL WASTE MANAGEMENT
SOIL NOT CAPPED	TON	$190.00	762		$144,748	CHEMICAL WASTE MANAGEMENT
CONCRETE NOT CAPPED	TON	$190.00	425		$80,798	CHEMICAL WASTE MANAGEMENT
TRANSPORTATION						CHEMICAL WASTE MANAGEMENT
800 MI	LOAD MI	$3.50	151		$422,800	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	2,723		$204,194	
LAND FILLING SUBTOTAL					$1,144,284	
					$1,860,254	
ENGINEERING AND ADMINISTRATIVE(20%)					$372,051	
HEALTH AND SAFETY-CONTRACTOR(15%)					$279,038	
CONTINGENCIES 25%					$465,063	
TOTAL CAPITAL COST					$2,976,406	

OPERATION AND MAINTENANCE	I=7% PRESENT WORTH			ANNUAL	PRESENT WORTH	
ANNUAL ENGINEERING INSPECTION	YR	$575		$575	$9,045	COMPENDIUM OF COSTS
DAILY PROPERTY CHECK	MO	$300		$3,600	$56,628	ASSUMED
MOWING(RIDING MOWER)	AC-YR	$26	6	$156	$2,454	MEANS, 1988 P. 88
REPAIRS						
RE-SEEDING, FERTILIZATION	AC-YR	$511	6	$3,064	$48,190	COMPARED TO COMPENDIUM P.10
EROSION CONTROL AND DRAINAGE MAINTENANCE	AC-YR	$200	6	$1,200	$18,876	COMPENDIUM OF COSTS P. 10
REPAIRS TO CAP	AC-YR	$200	6	$1,200	$18,876	COMPARED TO COMPENDIUM P. 10

(SHRINK/ SWELL OR FREEZE THAW)						
SUMP PUMPING	HR	$4.90	72	$355	$5,581	MEANS& CALC. 40 IN/YR-6 AC
SUBTOTAL OPERATION AND MAINTENANCE				$10,149	$159,650	
CONTINGENCY(25%)				$2,537	$39,912	
TOTAL OPERATION AND MAINTENANCE				$12,687	$199,562	
TOTAL					$3,175,968	

CAP ALTERNATIVE 5
INCINERATE ANY MATERIALS REMOVED FROM THE SITE

CAPITAL COSTS

SURFACE CAPPING				LEVELC		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
CUT FILL AND LEVEL PRIOR TO CAPPING	C.Y.	$1.26	7884	4	$39,735	
(AVE. 3 FT CUT AND FILL)						
SOIL LAYER W TOP SOIL	C.Y.	$7.00	18,750		$131,250	ESTIMATING DEPT
SAND LAYER	C.Y.	$15.00	8,920		$133,800	ESTIMATING DEPT
COMPACTED CLAY	C.Y.	$7.00	17,550		$122,850	ESTIMATING DEPT
BENTONITE ADMIX(9 LBS PER C.Y.)	LB	$0.19	157,950		$30,011	MEANS, 1988
40 MIL LINER	S.F	$0.40	275,000		$110,000	GUNDLE, 9/89
FILTER FABRIC	S.F	$0.15	275,000		$41,250	GUNDLE, 9/89
PERIMETER TRENCH(2715' LENGTH)						
EXCAVATE	C.Y	$6.00	830	4	$19,920	AVE. EXCAVATION COST USPCI
BACKFILL W/ GRAVEL	C.Y	$15.00	822		$12,330	ESTIMATING DEPT
4" PERFORATED PVC	L.F	$6.00	2715		$16,290	MEANS, 1988
4" PVC ELBOWS		$6.00	11		$66	MEANS, 1988
SUMP WELLS		$500.00	4		$2,000	ESTIMATING DEPT.
ELEC. SUMP PUMP(6" IMPELLER)		$1,500.00	4		$6,000	ASSUMED
LANDSCAPE						
SEED, FERTILIZE & MULCH	AC	$1,250	6		$7,500	ESTIMATING
SUB-TOTAL					$673,002	

SURFACE SOILNOT CAPPED(2 FT DEEP)			5008.5	LEVEL C		
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	
EXCAVATE W/LOADER	C.Y	$6.00	381	4	$9,144	AVE. EXCAVATION COST USPCI
HAND SHOVEL 2" LIFT	C.Y.	$33.00	31	4	$4,066	MEANS, 1988
FRONT END LOADER	HR	$17.00	31	4	$2,094	MEANS, 1988
OPERATOR	HR	$20.00	31	4	$2,464	MEANS, 1988

CONCRETE REMOVAL ALONG PROPERTY LINE			5008.5	LEVEL C			
REMOVE CONCRETE	C.Y	$30.00	210	4		$25,200	
SUBTOTAL						$42,968	
INCINERATION							
PERIMETER TRENCH EXCAVATION(OPTION)	TON	$2,000.00	1,536			$3,071,000	CHEMICAL WASTE MANAGEMENT
SOIL NOT CAPPED	TON	$2,000.00	762			$1,523,660	CHEMICAL WASTE MANAGEMENT
CONCRETE NOT CAPPED	TON	$2,000.00	425			$850,500	CHEMICAL WASTE MANAGEMENT
TRANSPORTATION							CHEMICAL WASTE MANAGEMENT
800 MI	LOAD MI	$3.50	151			$422,800	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	2,723			$204,194	
INCINERATION SUBTOTAL						$6,072,154	
						$6,788,123	
ENGINEERING AND ADMINISTRATIVE(20%)						$375,101	
HEALTH AND SAFETY-CONTRACTOR(15%)						$281,326	
CONTINGENCIES 25%						$468,876	
TOTAL CAPITAL COST						**$7,913,426**	
OPERATION AND MAINTENANCE	I=7% PRESENT WORTH				ANNUAL	PRESENT WORTH	
ANNUAL ENGINEERING INSPECTION	YR	$575			$575	$9,045	COMPENDIUM OF COSTS
DAILY PROPERTY CHECK	MO	$300			$3,600	$56,628	ASSUMED
MOWING(RIDING MOWER)	AC-YR	$26	6		$156	$2,454	MEANS, 1988 P. 88
REPAIRS							
RE-SEEDING, FERTILIZATION	AC-YR	$511	6		$3,064	$48,190	COMPARED TO COMPENDIUM P.10
EROSION CONTROL AND DRAINAGE MAINTENANCE	AC-YR	$200	6		$1,200	$18,876	COMPENDIUM OF COSTS P. 10
REPAIRS TO CAP	AC-YR	$200	6		$1,200	$18,876	COMPARED TO COMPENDIUM P. 10

(SHRINK/ SWELL OR FREEZE THAW)						
SUMP PUMPING	HR	$4.90	72	$355	$5,581	MEANS& CALC. 40 IN/YR-6 AC
SUBTOTAL OPERATION AND MAINTENANCE				$10,149	$159,650	
CONTINGENCY(25%)				$2,537	$39,912	
TOTAL OPERATION AND MAINTENANCE				$12,687	$199,562	
TOTAL					$8,112,988	

DEMOLITION OF BUILDING, KEEP SLAB--ALTERNATIVE 5
LANDFILLING OF MATERIAL REMOVED FROM THE SITE

DEMOLITION MAIN BUILDING	UNITS	UNIT COST	MATERIAL	LEVEL C	COST	SOURCE
BUILDING DEMOLITION(MAIN)	C.F	$0.05	1,874,000	4	$374,800	ESTIMATE
DEMOLITION SOUTH WARE.						
BUILDING DEMOLITION(SOUTH)	C.F	$0.05	243,750	4	$48,750	ESTIMATE
SUBTOTAL					$423,550	
LANDFILLING						
MAIN BLDG. STR	TON	$190.00	510		$96,900	CHEMICAL WASTE MANAGEMENT
SOUTH WARE STR	TON	$190.00	34		$6,460	
SHED	TON	$190.00	2		$380	
INSULATION(MAIN & SOUTH)	TON	$190.00	12		$2,280	
TRANSPORTATION						
800 MI-18 TON TRUCK	LOAD MI	$3.50	31		$86,800	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	558		$41,850	
SUBTOTAL					$234,670	
TOTAL					$658,220	
ENGINEERING AND ADMINISTRATIVE(20%)					$131,644	
HEALTH AND SAFETY-CONTRACTOR(15%)					$98,733	
CONTINGENCIES 25%					$164,555	
TOTAL CAPITAL COSTS					$1,053,152	

DEMOLITION OF BUILDINGS, KEEP SLAB—ALTERNATIVE 5
INCINERATE MATERIAL REMOVED FROM SITE

DEMOLITION MAIN BUILDING	UNITS	UNIT COST	MATERIAL	LEVEL C	COST	SOURCE
BUILDING DEMOLITION(MAIN)	C.F	$0.05	1,874,000	4	$374,800	ESTIMATE
DEMOLITION SOUTH WARE.						
BUILDING DEMOLITION(SOUTH)	C.F	$0.05	243,750	4	$48,750	ESTIMATE
SUBTOTAL					$423,550	
INCINERATION						
MAIN BLDG. STR	TON	$2,000.00	510		$1,020,000	CHEMICAL WASTE MANAGEMENT
SOUTH WARE STR	TON	$2,000.00	34		$68,000	
SHED	TON	$2,000.00	2		$4,000	
INSULATION(MAIN & SOUTH)	TON	$2,000.00	12		$24,000	
TRANSPORTATION						
800 MI-18 TON TRUCK	LOAD MI	$3.50	31		$86,800	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES, ANALSIS, PERMITS)	TON	$75.00	558		$41,850	
SUBTOTAL					$1,244,650	
TOTAL					$1,668,200	
ENGINEERING AND ADMINISTRATIVE(20%)					$131,167	
HEALTH AND SAFETY-CONTRACTOR(15%)		SAME AS LANDFILLING OPTION			$98,375	
CONTINGENCIES 25%					$163,959	
TOTAL CAPITAL COSTS					$2,061,701	

ALTERNATIVE 6 : DECONTAMINATION OF BUILDINGS AND REMOVAL OF SLAB

DECONTAMINATION OF STRUCTURES

MAIN BUILDING

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	250,000		$50,000	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES W PENTANONE	S.F.	$4.00	150,000		$600,000	ENSR $4.00 TO $5.00 SQ FT.
REMOVE SLAB						
6" SLAB MESH REINFORCED	C.Y	$30.00	2,024	4	$242,926	$30/ CU YD NON-HAZARDOUS
ON-SITE SAMPLE ANALYSIS					$92,000	EST. 25% OF FINAL SAMPLING
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ. FT. ASSUMED)	SAMPLE	$185.00	1,500		$277,500	EMS LABS, W/O VOL. DISCOUNT
SUBTOTAL					1,262,426	

SOUTH WAREHOUSE

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
PREPARATION FOR SOLVENT CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM	S.F.	$0.20	19,750		$3,950	ESTIMATE
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES W PENTANONE	S.F.	$4.00	10,000		$40,000	ENSR $4.00 TO $5.00 SQ FT.
REMOVE SLAB						
6" SLAB MESH REINFORCED	C.U.	$30.00	211	4	$25,278	$30/ CU YD NON-HAZARDOUS
ON-SITE SAMPLE ANALYSIS					$6,161	EST. 25% OF FINAL SAMPLING
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)		$185.00	100		$18,500	EMS LABS, W/O VOL. DISCOUNT

SUBTOTAL				$93,888	
LANDFILING AT					
MAIN BLDG.SLAB	TON	$190.00	4,099	$778,881	CHEMICAL WASTE MANAGEMENT
SOUTH WARE SLAB	TON	$190.00	416	$78,969	
TRANSPORTATION					
800 MI-18 TON TRUCK	LOAD MI	$3.50	251	$702,800	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	4,515	$338,625	
SUBTOTAL				$1,899,275	
TOTAL				$3,255,589	
ENGINEERING AND ADMINISTRATIVE(20%)				$651,118	
HEALTHAND SAFETY-CONTRACTOR(15%)				$488,338	
CONTINGENCIES 25%				$813,897	
TOTAL CAPITAL COST				$5,208,943	

ALTERNATIVE 6: DECONTAMINATE STRUCTURES AND REMOVE SLABS
INCINERATE MATERIALS REMOVED FROM SITE

DECONTAMINATION OF STRUCTURES
MAIN BUILDING

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
PREPARATION FOR SOLVENT	S.F.	$0.20	250,000		$50,000	ESTIMATE
CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM						
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES W PENTANONE	S.F.	$4.00	150,000		$600,000	ENSR $4.00 TO $5.00 SQ FT.
REMOVE SLAB						
6" SLAB MESH REINFORCED	C.Y	$30.00	2,024	4	$242,926	$30/ CU YD NON-HAZARDOUS
ON-SITE SAMPLE ANALYSIS					$92,000	EST. 25% OF FINAL SAMPLING
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ. FT. ASSUMED)	SAMPLE	$185.00	1,500		$277,500	EMS LABS, W/O VOL. DISCOUNT
SUBTOTAL					1,262,426	
SOUTH WAREHOUSE						
PREPARATION FOR SOLVENT	S.F.	$0.20	19,750		$3,950	ESTIMATE
CLEANING: PLUG HOLES, DRAINS, DIKE DOORWAYS, REMOVE INSULATION, VACUUM						
SOLVENT WASHING (WALLS AND CEILING). VACCUMING OF SOLVENT. 3 PASSES W PENTANONE	S.F.	$4.00	10,000		$40,000	ENSR $4.00 TO $5.00 SQ FT.
REMOVE SLAB						
6" SLAB MESH REINFORCED	C.U.	$30.00	211	4	$25,278	$30/ CU YD NON-HAZARDOUS
ON-SITE SAMPLE ANALYSIS					$6,161	EST. 25% OF FINAL SAMPLING
POST CLEANUP SAMPLING (ONE SAMPLE PER 100 SQ FT ASSUMED)		$185.00	100		$18,500	EMS LABS, W/O VOL. DISCOUNT

SUBTOTAL				$93,888	
INCINERATION					
MAIN BLDG.SLAB	TON	$2,000.00	4,099	$8,198,750	CHEMICAL WASTE MANAGEMENT
SOUTH WARE SLAB	TON	$2,000.00	416	$831,250	
TRANSPORTATION					
800 MI-18 TON TRUCK	LOAD MI	$3.50	251	$702,800	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	4,515	$338,625	
SUBTOTAL				$10,071,425	
TOTAL				$11,427,739	
ENGINEERING AND ADMINISTRATIVE(20%)				$651,118	
HEALTH AND SAFETY-CONTRACTOR(15%)		SAME AS LANDFILLING OPTION		$488,338	
CONTINGENCIES 25%				$813,897	
TOTAL CAPITAL COST				$13,381,093	

REMOVAL OF SOILS ≥ 10 PPM PCBS-- ALTERNATIVE 6,7
LANDFILLING OF MATERIALS REMOVED FROM SITE
SURFACE SOIL (35,000 S.F.)

OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
SURFACE SOILS > 10 PPM PCBS						
EXCAVATE W/LOADER	C.Y	$6.00	2,377	4	$57,037	AVE COST OF EXCAVATION(USPCI)
HAND SHOVEL 2" LIFT	C.Y.	$33.00	216	4	$28,519	MEANS, 1988
FRONT END LOADER	HR	$17.00	27	4	$1,836	MEANS, 1988
OPERATOR	HR	$20.00	27	4	$2,160	MEANS, 1988
BACKFILL W SOIL	C.Y	$15.00	2,593		$38,889	ESTIMATING DEPT.
SUBSURFACE SOIL						
SUBSURFACE SOILS > 10 PPM PCBS						
TEST PIT P-1	C.Y	$6.00	8	4	$192	AVE COST OF EXCAVATION(USPCI)
TEST TRENCH 1	C.Y	$6.00	185	4	$4,444	AVE COST OF EXCAVATION(USPCI)
BORING B-20	C.Y	$6.00	185	4	$4,444	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y	$6.00	334	4	$8,016	AVE COST OF EXCAVATION(USPCI)
EXTRA SOIL UNDER MAIN & S. SLAB(25%)	C.Y.	$6.00	958	4	$22,989	
BACKFILL W SOIL	C.Y	$15.00	1,670		$25,054	ESTIMATING DEPT.
SUBTOTAL					$193,581	
LANDFILLING						
SURFACE SOIL(130 PCF)	TON	$190.00	4,550		$864,500	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL(130 PCF)	TON	$190.00	1,250		$237,540	CHEMICAL WASTE MANAGEMENT
ADDITIONAL SUBSURFACE BLG.(25%) (1 FOOT)	TON	$190.00	1,681		$319,402	
TRANSPORTATION						
800 MI	LOAD MI	$3.50	416		$1,164,800	$3.00 TO $3.50 WELL DOCUMENTED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	7,481		$561,095	
SUBTOTAL					$3,147,337	
POST CLEANUP SAMPLING						
EXPOSED BUILDING SURFACE SOIL						
50X50	SAMPLE	$187.00	41		$7,667	
25X25	SAMPLE	$187.00	41		$7,667	
SURFACE						

COLLECT, PACK, SHIP	DAY	$200.00	2.95	$590	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	59	$11,033	EMS LABS, W/0 VOL. DISCOUNT
SUBSURFACE					
COLLECT, PACK, SHIP	DAY	$200.00	0.60	$120	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	12	$2,244	EMS LABS, W/0 VOL. DISCOUNT
SUBTOTAL				$29,321	
TOTAL				$3,370,239	
ENGINEERING AND ADMINISTRATIVE(20%)				$674,048	
HEALTHAND SAFETY-CONTRACTOR(15%)				$505,536	
CONTINGENCIES 25%				$842,560	
TOTAL CAPITAL COSTS				$5,392,382	

REMOVAL OF SOILS ≥ 10 PPM PCBS— ALTERNATIVE 6,7
INCINERATE MATERIAL REMOVED FROM SITE
SURFACE SOIL (35,000 S.F.)

SURFACE SOILS > 10 PPM PCBS						
OPERATION	UNIT	UNIT COST	UNITS	MULTIPLIER	COST	SOURCE
EXCAVATE W/LOADER	C.Y	$6.00	2,377	4	$57,037	AVE COST OF EXCAVATION(USPCI)
HAND SHOVEL 2" LIFT	C.Y.	$33.00	216	4	$28,519	MEANS, 1988
FRONT END LOADER	HR	$17.00	27	4	$1,836	MEANS, 1988
OPERATOR	HR	$20.00	27	4	$2,160	MEANS, 1988
BACKFILL W SOIL	C.Y	$15.00	2,593		$38,889	ESTIMATING DEPT.
SUBSURFACE SOIL						
SUBSURFACE SOILS > 10 PPM PCBS						
TEST PIT P-1	C.Y	$6.00	8	4	$192	AVE COST OF EXCAVATION(USPCI)
TEST TRENCH 1	C.Y	$6.00	185	4	$4,444	AVE COST OF EXCAVATION(USPCI)
BORING B-20	C.Y	$6.00	185	4	$4,444	AVE COST OF EXCAVATION(USPCI)
SITE STORM SEWER	C.Y	$6.00	334	4	$8,016	AVE COST OF EXCAVATION(USPCI)
EXTRA SOIL UNDER MAIN & S. SLAB(25%)	C.Y.	$6.00	958	4	$22,989	
BACKFILL W SOIL	C.Y	$15.00	1,670		$25,054	ESTIMATING DEPT.
SUBTOTAL					$193,581	
INCINERATION						
SURFACE SOIL(130 PCF)	TON	$2,000.00	4,550		$9,100,000	CHEMICAL WASTE MANAGEMENT
SUBSURFACE SOIL(130 PCF)	TON	$2,000.00	1,250		$2,500,420	CHEMICAL WASTE MANAGEMENT
ADDITIONAL SUBSURFACE BLG.(25%) (1 FOOT)	TON	$2,000.00	1,681		$3,362,125	
TRANSPORTATION						
800 MI	LOAD MI	$3.50	416		$1,164,800	$3.00 TO $3.50 WELL DOCUMENTED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	7,481		$561,095	
SUBTOTAL					$16,688,440	
POST CLEANUP SAMPLING						
EXPOSED BUILDING SURFACE SOIL						
50X50	SAMPLE	$187.00	41		$7,667	
25X25	SAMPLE	$187.00	41		$7,667	
SURFACE						

COLLECT, PACK, SHIP	DAY	$200.00	2.95	$590	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	59	$11,033	EMS LABS, W/O VOL. DISCOUNT
SUBSURFACE					
COLLECT, PACK, SHIP	DAY	$200.00	0.60	$120	ASSUME 20 SAMPLES PER DAY
ANALYSE(PCBS ONLY)	SAMPLE	$187.00	12	$2,244	EMS LABS, W/O VOL. DISCOUNT
SUBTOTAL				$29,321	
TOTAL				$16,911,342	
ENGINEERING AND ADMINISTRATIVE(20%)				$620,416	
HEALTH AND SAFETY-CONTRACTOR(15%)	SAME AS LANDFILLING OPTION			$465,312	
CONTINGENCIES 25%				$775,520	
TOTAL CAPITAL COSTS				$18,772,590	

DEMOLITION OF BUILDINGS-ALTERNATIVES 7,8
LANDFING OF MATERIAL REMOVED FROM SITE

DEMOLITION MAIN BUILDING	UNITS	UNIT COST	MATERIAL	LEVEL C	COST	SOURCE
BUILDING DEMOLITION(MAIN)	C.F	$0.05	1,874,000	4	$374,800	ESTIMATE
SLAB DEMO	CY	$30.00	2,024	4	$242,926	$ 30/C.Y. AVE FOR NON-HAZ.
DEMOLITION OF SHED						
BUILDING DEMOLITION	C.F.	$0.05	3,200	4	$640	
SLAB DEMO	CY	$30.00	7	4	$830	$ 30/C.Y. AVE FOR NON-HAZ.
DEMOLITION SOUTH WARE.						
BUILDING DEMOLITION	C.F	$0.05	195,000	4	$39,000	ESTIMATE
SLAB DEMO	CY	$30.00	211	4	$25,278	$ 30/C.Y. AVE FOR NON-HAZ.
SUBTOTAL					$683,473	
LANDFILLING AT EMELLE						
MAIN BLDG. STR	TON	$190.00	510		$96,900	CHEMICAL WASTE MANAGEMENT
MAIN BUILDING SLAB	TON	$190.00	4,099		$778,881	
SOUTH WARE STR	TON	$190.00	34		$6,460	
SOUTH WARE SLAB	TON	$190.00	427		$81,047	
SHED STR.	TON	$190.00	2		$380	
SHED SLAB	TON	$190.00	14		$2,660	
INSULATION(MAIN AND SOUTH)	TON	$190.00	12		$2,280	
TRANSPORTATION						
800 MI-18 TON TRUCK	LOAD MI	$3.50	283		$792,400	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	5,098		$382,345	
SUBTOTAL					$2,143,353	
TOTAL					$2,826,827	
ENGINEERING AND ADMINISTRATIVE-(20%)					$565,365	
HEALTH AND SAFETY-CONTRACTOR(15%)					$424,024	
CONTINGENCIES 25%					$706,707	
TOTAL CAPITAL COSTS					$4,522,923	

DEMOLITION OF BUILDINGS-ALTERNATIVES 7,8
INCINERATION

DEMOLITION MAIN BUILDING	UNITS	UNIT COST	MATERIAL	LEVEL C	COST	SOURCE
BUILDING DEMOLITION(MAIN)	C.F	$0.05	1,874,000	4	$374,800	ESTIMATE
SLAB DEMO	CY	$30.00	2,024	4	$242,926	$ 30/C.Y. AVE FOR NON-HAZ.
DEMOLITION OF SHED						
BUILDING DEMOLITION	C.F.	$0.05	3,200	4	$640	
SLAB DEMO	CY	$30.00	7	4	$830	$ 30/C.Y. AVE FOR NON-HAZ.
DEMOLITION SOUTH WARE.						
BUILDING DEMOLITION	C.F	$0.05	195,000	4	$39,000	ESTIMATE
SLAB DEMO	CY	$30.00	211	4	$25,278	$ 30/C.Y. AVE FOR NON-HAZ.
SUBTOTAL					$683,473	
INCINERATION						
MAIN BLDG. STR	TON	$2,000.00	510		$1,020,000	CHEMICAL WASTE MANAGEMENT
MAIN BUILDING SLAB	TON	$2,000.00	4,099		$8,198,750	
SOUTH WARE STR	TON	$2,000.00	34		$68,000	
SOUTH WARE SLAB	TON	$2,000.00	427		$853,125	
SHED STR.	TON	$2,000.00	2		$4,000	
SHED SLAB	TON	$2,000.00	14		$28,000	
INSULATION(MAIN+SOUTH)	TON	$2,000.00	12		$24,000	
TRANSPORTATION						
800 MI-18 TON TRUCK	LOAD MI	$3.50	283		$792,400	$3.00 TO $3.50 WELL ESTABLISHED
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	5,098		$382,345	
SUBTOTAL					$11,370,620	
TOTAL					$12,054,094	
ENGINEERING AND ADMINISTRATIVE(20%)					$565,365	
HEALTH AND SAFETY-CONTRACTOR(15%)					$424,024	
CONTINGENCIES 25%					$706,707	
TOTAL CAPITAL COSTS					$13,750,190	

ALTERNATIVE 8-REMOVE SOIL >0.35 PPM

LANDFILLING OF MATERIAL REMOVED FROM THE SITE

OPERATION	UNIT	UNIT COST	UNITS	1ULTIPLIEI	COST	SOURCE
REMOVAL OF ONSITE SURFACE SOIL EXCEEDING 0.35 PPM PCBS						
OPERATION(EXCASVATE TO 2')	UNIT	UNIT COST	UNITS	1ULTIPLIEI	COST	
EXCAVATE W/LOADER	C.Y	$6.00	13467	4	$323,208	
BACKFILL	C.U.	$15.00	13467		202005	
REMOVAL OF ONSITE SUBSURFACE SOIL EXCEEDING 0.35 PPM PCBS						
EXCAVATE ADDITIONAL 6 FT IF NECESSARY						
EXCAVATE W/LOADER	C.Y	$6.00	61038	4	$1,464,912	
BACKFILL W SOIL	C.Y	$15.00	61038		$915,570	
SUBTOTAL					$2,905,695	
LANDFILLING						
SURFACE SOIL	TON	$190.00	23635		$4,490,571	
SUBSURFACE SOIL	TON	$190.00	107122		$20,353,121	
TRANSPORTATION						
800 MI	LOAD MI	$3.50	7264		$20,339,200	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	130,756		$9,806,721	
POST CLEAN-UP SAMPLING						
(50 FT GRID)						
COLLECT	DAY	$200.00	8		$1,556	
PACK, SHIP	SAMPLE	$2.00	140		$280	
ANALYSE	SAMPLE	$187.50	140		$26,250	
SUBTOTAL					$55,017,698	
TOTAL					$57,923,393	
ENGINEERING AND ADMINISTRATIVE(20%)					$11,584,679	
HEALTH AND SAFETY-CONTRACTOR(15%)					$8,688,509	
CONTINGENCIES 25%					$14,480,848	
TOTAL CAPITAL COSTS					$92,677,429	

ALTERNATIVE 8-REMOVE SOIL >0.35 PPM
INCINERATION OF MATERIAL REMOVED FROM SITE

OPERATION	UNIT	UNIT COST	UNITS	1ULTIPLIEI	COST	SOURCE
REMOVAL OF ONSITE SURFACE SOIL EXCEEDING 0.35 PPM PCBS						
OPERATION(EXCASVATE TO 2')	UNIT	UNIT COST	UNITS	1ULTIPLIEI	COST	
EXCAVATE W/LOADER	C.Y	$6.00	13467	4	$323,208	
BACKFILL	C.U.	$15.00	13467		202005	
REMOVAL OF ONSITE SUBSURFACE SOIL EXCEEDING 0.35 PPM PCBS						
EXCAVATE ADDITIONAL 6 FT IF NECESSARY						
EXCAVATE W/LOADER	C.Y	$6.00	61038	4	$1,464,912	
BACKFILL W SOIL	C.Y	$15.00	61038		$915,570	
SUBTOTAL					$2,905,695	
INCINERATION						
SURFACE SOIL	TON	$2,000.00	23635		$47,269,170	
SUBSURFACE SOIL	TON	$2,000.00	107122		$214,243,380	
TRANSPORTATION						
800 MI	LOAD MI	$3.50	7264		$20,339,200	
MISC.(TAXES,ANALSIS,PERMITS)	TON	$75.00	130,756		$9,806,721	
POST CLEAN-UP SAMPLING						
(50 FT GRID)						
COLLECT	DAY	$200.00	8		$1,556	
PACK, SHIP	SAMPLE	$2.00	140		$280	
ANALYSE	SAMPLE	$187.50	140		$26,250	
SUBTOTAL					$291,686,556	
TOTAL					$294,592,251	
ENGINEERING AND ADMINISTRATIVE(20%)					$11,584,679	
HEALTH AND SAFETY-CONTRACTOR(15%)					$8,688,509	
CONTINGENCIES 25%					$14,480,848	
TOTAL CAPITAL COSTS					$329,346,287	

ALTERNATIVE 8

REMOVAL OF SEDIMENT FROM 3 STORM WATER RETENTION PONDS ≥0.35 PPM PCBS
LANDFILLING OF MATERIAL REMOVED FROM THE SITE

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	
BACKFILL WITH SOIL	C.Y	$15.00	5040		$75,600	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE & 2" IMPELLER)	DAY	$17.70	6.73		$119	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	162		$58	MEANS 1989, P14
ACTIVATED CARBON TREATMENT (50 GPM ASSUMED AS UNIT CAPACITY)	GAL	$0.30	484704		$145,411	COMPENDIUM OF COSTS P. 109
DISCHARGE TO POTW	1000GAL	$1.00	485		$485	ESTIMATE
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED. SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
EXCAVATE(6FT)	C.Y.	$6.00	2,640	4	$63,360	
LANDFILL COST	TON	$190.00	4,633		$880,308	
TRANSPORTATION	LOAD-MI	$3.50	257		$719,600	
MISC(TAXES, ANALSIS, PERMITS)	TON	$75.00	4,633		$347,490	
POSTCLEANUP SAMPLING (50 FT GRID)						
COLLECT	DAY	$200.00	0.42		$83	
PACK, SHIP	SAMPLE	$2.00	5		$10	
ANALYSIS	SAMPLE	$187.50	5		$938	
SUBTOTAL					$2,233,462	
ENGINEERING AND ADMINISTRATIVE(20%)					$446,692	
HEALTH AND SAFETY-CONTRACTOR(15%)					$335,019	
CONTINGENCIES 25%					$558,366	
TOTAL CAPITAL COSTS					$3,573,539	

ALTERNATIE 8
REMOVAL OF SEDIMENT FROM 3 STORM WATER RETENTION PONDS ≥0.35 PPM PCBS
INCINERATION

OPERATION	UNIT	UNIT COST	UNITS	LEVEL C MULTIPLIER	COST	
BACKFILL WITH SOIL	C.Y	$15.00	5040		$75,600	ESTIMATING DEPT
DEWATERING OF PONDS						
PUMP RENTAL(W GAS ENGINE & 2" IMPELLER)	DAY	$17.70	6.73		$119	MEANS 1989, P 14
OPERATING EXPENSE	HR	$0.36	162		$58	MEANS 1989, P14
ACTIVATED CARBON TREATMENT	GAL	$0.30	484704		$145,411	COMPENDIUM OF COSTS
(50 GPM ASSUMED AS UNIT CAPACITY)						P. 109
DISCHARGE TO POTW	1000GAL	$1.00	485		$485	ESTIMATE
SEDIMENT DEWATERING	ASSUMED PONDS WERE DRAINED AND WATER TREATED. SEDIMENTS FAIRLY DRY ASSUMING NO RAIN.					
EXCAVATE(6FT)	C.Y.	$6.00	2,640	4	$63,360	
INCINERATION	TON	$2,000.00	4,633		$9,266,400	
TRANSPORTATION	LOAD-MI	$3.50	257		$719,600	
MISC.(TAXES, ANALSIS, PERMITS)	TON	$75.00	4,633		$347,490	
POST CLEANUP SAMPLING						
(50 FT GRID)						
COLLECT	DAY	$200.00	0.42		$83	
PACK, SHIP	SAMPLE	$2.00	5		$10	
ANALYSIS	SAMPLE	$187.50	5		$938	
SUBTOTAL					$10,619,554	
ENGINEERING AND ADMINISTRATIVE(20%)					$446,692	
HEALTH AND SAFETY-CONTRACTOR(15%)					$335,019	
CONTINGENCIES 25%					$558,366	
TOTAL CAPITAL COSTS					$11,959,631	